MUD Pie School

AUTHENTIC PUBLISHING ON THE INTERNET

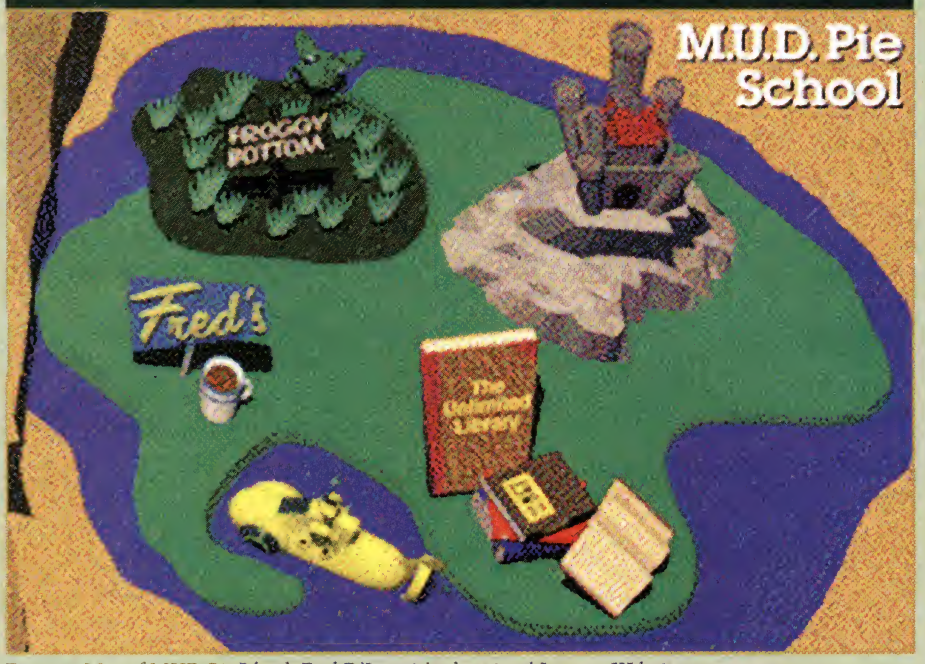

Figure 1. Map of MUD Pie Island, Fred D'Ignazio's educational Internet Web site.

Because the Internet makes the audience and the medium freely accessible to students, their authentic publishing projects can be easier, more frequent, and more effective.

By Fred D'Ignazio

I believe in authoring as a powerful method for learning—in all subjects, in all grades, and continuing throughout a person's life. As you know, I have been an author, sharing what I have learned with students and teachers in at least 25 books in addition to my column in *L&L*. I have advocated students doing authentic publishing, which includes conducting real-world research, identifying a bona fide audience, and focusing on subjects that have meaning to the students and contribute to everyone's knowledge of the world. If you have been reading my columns over the years, you know that I believe the Internet presents a remarkable opportunity for students to do authentic publishing.

Figure 2. Dr. Frederick Dejeuner (at left) is the "principal" of MUD Pie School.

Authentic Publishing on the Internet

In the near future, the Internet will be more accessible and less expensive, and it will play a growing part in student's daily authoring and researching tasks. Through the power of telecommunications, students will be able to journey out of the classroom regularly to do online research around the world, interview content experts in real time, and collaborate with other student authors in remote classrooms. These resources will be part of your life and your students' lives before you know it.

Welcome to MUD Pie School

To prepare yourselves to be authors in these new educational "worlds," I have constructed a beginner's world I call MUD (Multimedia U Design) Pie Island. It is a make-believe island, created purely out of my imagination, but it has a serious purpose. On MUD Pie Island I have built an authors' school, a map of which is shown in Figure 1, that helps newcomers get started.

Meet Our Zany Faculty

Life at MUD Pie School couldn't be simpler. Today there are only five classrooms on MUD Pie Island, designed around the five-part strategy that I have written about in my *L&L* columns over the years: real-world research, multimedia authoring, research on the Internet, conducting online interviews, and publishing Internet Web pages. You and your students can attend this school at: http://www.mudpie.org.

These classrooms are run by a band of quirky teachers who are led by their good-natured principal, Dr. Frederick Dejeuner (Figure 2). The rest of our faculty is pictured in the "MUD Pie Faculty"

adopters are usually higher in social and economic status and have control of significantly more resources than later adopters.) This approach may be more challenging for the diffusion worker, but ultimately it may be better suited to certain contexts, especially when equity issues are primary concerns within the social system.

Putting Knowledge Into Action

Hopefully, by now you are starting to think of differentiated ways in which you could approach members of these five different groups in your diffusion work. Here are some suggestions. Please remember that this is an unfinished list, and that because every social system is unique, not all of these techniques will be equally effective in every context.

Innovators. Stay out of their way! Keep them supplied with as many resources (e.g., hardware, software, connectivity, individualized instruction, interpersonal connections, administrative permission, project calls for participation, guidelines for grant proposals, and keys to the computer lab) as possible. Try to shield them from bureaucratic red tape, others' jealousy, and parental ire. Help them find other innovators both inside the local system and beyond with whom they can explore innovation applications. Don't force or coerce them to teach others, especially those who are less innovative in their approaches.

Early Adopters. Make their successes public, but be careful to allow them to make innovation adoption decisions at their own pace. Don't push! Instead, offer, again and again, to help them to explore rich, well-grounded, high-quality applications of innovations. For teachers, this means exposing them to curriculum-based, educationally sound learning activities and projects that are clearly linked to what they already do in their classrooms. Remember that, more than any other group, these folks will "sell" the innovation for you to their peers. Don't rush them into doing so. They will figure out powerful, persuasive uses and reasons for adoption if you support and encourage their judicious innovation trials.

Early Majority. Make good use of this group's relatively large size and especially its preference for interaction with other social system members. Encourage collaborative explorations and applications of new tools, ideas, and techniques. (Telecollaborative tools, like electronic mail, chatting services, and bulletin boards, should be quite appealing to many in this group.) Be patient! These people will take much longer than the groups that preceded them in making adoption decisions, but once they do so they will apply the tools consciously, confidently, and conspicuously. Once they begin to embrace the innovation, the overall rate of diffusion in the social system will quicken. Be ready to move faster once this occurs!

Late Majority. You probably won't have to work that hard to get these folks to try a new idea, tool, or technique. Said another way, no matter how hard you try, these folks probably won't adopt the innovation until its use is common in the social system. Why set unrealistic expectations for yourself? The more you can publicize the use of the innovation as "normal" and "expected," the better chance you have in winning over these cautious folks. Don't force them, embarrass them, or get frustrated with them. More importantly, make sure they have the resources they see as prerequisite to considering adoption. Keep offering opportunities, undeterred by lack of response, and one day, they will accept.

Laggards. Some educational technologists suggest that the best strategy to use with a laggard is to wait until they retire <grin>. Instead, I suggest that you use techniques similar to those offered for late majority members, but with even more patience, acceptance, and attempts to see the situation from their points of view. When the use of an innovation is perceived by most as being "the way that we do things here," the laggards will (perhaps reluctantly, and surely quietly) come along. Keep their secret for and with them. It's not remarkable that they finally relented. Use of the innovation has now become the overwhelming behavioral norm.

Reminders

Rogers tells us that there are some social systems for which innovation adoption does not proceed according to this predictable pattern, so if that is apparent in your context try to figure out why this difference is occurring. This will help you to know how best to encourage diffusion under a different set of conditions.

Also, keep in mind another remarkably consistent finding that diffusion researchers have documented in their work with telecommunications. No matter what the nature of the social system, it has been found that only about 10% of all the users of a telecomputing system generate about 50% of all of the traffic on the system. Isn't that amazing? That means that the other 90% of the users contribute the other 50% of the use. Therefore, expect everyone to use the tools, ideas, and resources that you have so carefully and persistently promoted very differently. As teachers, we try our best to recognize, respect, and accommodate the different needs, interests, and preferences of students. When teachers are our students, we should proceed similarly. ■

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Resources

Rogers, E. M. (1986). *Communication technology: The new media in society.* New York: The Free Press. ISBN: 0–02–927120–7

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: The Free Press. ISBN: 0–02–926671–8

section on page 60, demonstrating the fun things you can do when you do authentic publishing using multimedia and the Internet with your students.

For classrooms that aren't on the Internet yet, I have also created a CD-ROM that contains copies of Netscape Navigator Gold and Claris Home Page, and step-by-step instructions on how to get online. The neat thing about MUD Pie School is you can create and publish Internet Web-style pages *even if you aren't on the Internet!*

Unlimited Library

At MUD Pie School I want to create a rich demonstration of students' authentic publishing projects. I have tremendous faith in students' abilities to do meaningful research, thinking, and imagining, and I want to provide a gallery to share every students' work with the world.

I invite you and your students to attend the free online version of MUD Pie School, create your own Web pages, and send them to me so that I can add them to the growing gallery of student work on the Internet. I hope that one day soon we will have hundreds or even thousands of home pages online as an impressive exhibition of knowledge created by kids for kids. Eventually, I hope to see these Web pages become online classrooms created and maintained by real-world students and real-world classrooms as an educational resource for students around the globe.

Multimedia on A Shoestring

You may be thinking that projects like these are designed for teachers with a lot more time and resources than you have. The bottom line: you can do multimedia if you keep it simple. I follow the K.I.S.S. rule: Keep It Simple to be Successful. If you keep it simple, you and your students can get in and out of multimedia before the bell rings.

How is this possible? Teachers have been doing this for years, and I've been writing about it in my Sandbox column in *L&L* magazine for almost as long. Ingenious teachers around the country have learned how to do multimedia on a shoestring. They have scarce resources, too little time, and not enough training or experience. Despite all this, they're still successful! They use equipment and other materials already on hand, and they produce the most amazing multimedia reports, portfolios, science projects, multimedia poems, and more with their students. Their trick is that they let the students do the work themselves. The teacher's job is to manage the overall process to make sure the kids meet their deadlines and that their multimedia creations are infused with solid content from the curriculum.

The key to success in your classroom is to trust your students. They have great ingenuity and they can't wait to get their hands on these new authoring tools. You need to give your students just enough information about the authoring tools to get started. After that, they will learn best from hands-on practice with their creations. They will teach each other. And they will teach you!

Send Me Your "MUD Pies" (Student Web Pages)

Hopefully the "Froggy Mystery" Web page and activity (described in the "MUD Pie School Research Project" inset on page 61) is just the first of many home pages at MUD Pie School. But the rest is up to you!

I invite all of my Sandbox column readers to send in their Web pages so that I can publish them on the Internet alongside our Froggy Mystery Web page. In the future I hope to have a huge gallery of student- and teacher-produced pages on every subject imaginable. I have great faith in teachers and students. I feel certain that the Web pages you create may be simple, but they will also be original, fun, and different, in addition to serving as helpful examples to other teachers and students all across the world.

In the long term, I hope to see students and teachers take on more of the teaching duties at MUD Pie School and use their Web pages as classrooms, such as the ones we've already developed—Dr. Franken-Fred's Lobotomy Lab, Detective Fred's Froggy Bottom, and Captain Fred's Diner.

Send your MUD Pie Web page on a Macintosh or PC disk with a disk label showing the file names of the files that are included, the computer platform (Mac or PC), and the names of the media files (images, sounds, etc.) that accompany the Web page. Also, put your name and phone number on the disk label so I don't mix up our MUD Pies! Last, on a separate sheet of paper, I will need a brief release from you and your students to display your work on the Internet (by the way, we have elaborate editing procedures to protect children's privacy and safety!) Please send your materials to: Dr. Dejeuner, Principal, MUD Pie School, at the address at the end of the article. I will send you a postcard within two to four weeks after receiving your MUD Pie to confirm that I have received your disk.

I hope you will go out on the Internet and visit MUD Pie School. You may also want to come to my Spotlight Session at the 1997 National Educational Computing Conference (NECC '97) in Seattle.

Special Offer

What do you do if you are not on the Internet, and not sure how to start? As a special offer to readers of this column, I am making available copies of my MUD Pie CD-ROM, for $25, which is the cost of production (the retail price is $50). This CD includes everything you need to learn the basics to get started. Also, I would like to offer you the *Teacher's Cookbook* (at cost) for $10. You can send checks to the address above, and include $3.00 per item for postage and handling.

Good luck! Be bold, creative, original, and inventive, and, above all, trust your students. I'm eager to display your MUD pies online! ■

Fred D'Ignazio is the editor of the Multimedia Sandbox column. Fred can be reached at Multimedia Classrooms, Inc., 1773 Walnut Street, East Lansing, MI 48823; digazio@msen.com.

MUD Pie Faculty

The MUD Pie Faculty can show you how fun it is to do authentic publishing activities using multimedia and the Internet.

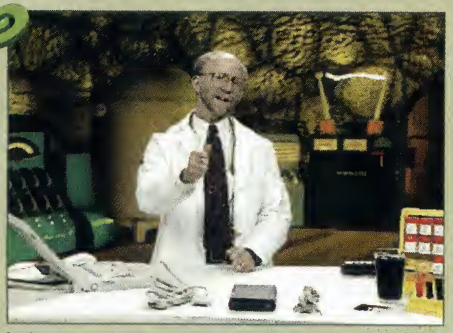
1

Use real-world research tools to gather materials for your Web page.

Froggy Bottom and Detective Fred

2

Set Up a multimedia workstation to capture your research onto the computer.



Lobotomy Lab and Dr. FrankenFred

3

Do research online and copy and paste it into your Web page.

Unlimited Library
and Professor Freddy Higginbottom

4

Interview experts online and paste the interviews into your Web page.

MM MUD Buggy and Captain Fred

5

Assemble images, text, and sounds onto your Web page and publish it on diskette, on a hard drive, or on the Internet.

Fred's Diner and Chef Fred

MUD PIE SCHOOL RESEARCH PROJECT

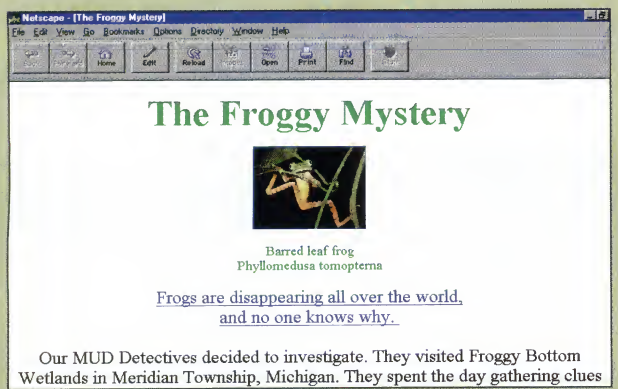
Froggy Mystery

What Is Happening to the Frogs?

Did you know that frogs are vanishing from their wetland habitats all over the world? This startling finding has scientists in many countries worried, because frogs and other amphibians are generally the first creatures in the ecosystem to be affected by ecological and environmental changes. If the world's environment is becoming hostile to frogs, what might that mean for humans and other species later on?

The chief question we want to answer through the research we're doing in the Froggy Bottom research project is "Why are frogs vanishing from their habitats?" This project meets all the criteria for authentic publishing: it is timely, it is meaningful to people all over the world, and it allows students to make a real contribution to our understanding of the problem by observing what is happening in their own communities. Furthermore, this project is exactly the type that would be enhanced by using the Internet to conduct research, collaborate with others, and publish our results. All 24 of the lessons at Froggy Bottom are about developing a Web page on vanishing frogs.

You and your students could use this topic, or another like it, as a theme for doing multimedia research, authoring, and publishing Web pages in your classroom.



Students investigate the frog populations in their area and publish their findings on the Internet.

"What I Did Last Summer" 21ST CENTURY STYLE

A new twist on an old project: Have students tell what they did over the summer by creating multimedia Web documents using text, spoken narration, sound effects, music, photos, their own drawings, and more!

By Fred D'Ignazio and Joanne Davis

Here's a great idea for next fall: Have your students write a report about what they do during the summer. "What makes that such a great idea?" you ask. "I do that every year." To make this time-honored project new and exciting for you and your students, don't have your students create paper-and-pencil reports and then read them to their classmates. Instead, have them create multimedia documents. They can publish their reports on disk, on your classroom computer's hard drive, on your school's local area network (LAN), or on the World Wide Web.

We followed a simple plan with our students at the beginning of last school year, which you can read about in this article. We created a minicourse for kids in our school system and had them attend a week-long "summer camp" to learn how to author a Web document entitled "What I Did Last Summer." As a consultant (Fred) and a resource teacher (Joanne), we were able to choose kids from a variety of grade levels, from third grade on up to college.

Student Guidelines

If you are interested in this kind of project, you can begin planning for it even before you send your students home for summer vacation. If possible, you can meet with your students and discuss your ideas with them so that they can begin gathering resource materials during their summer vacations. You should also discuss this with their parents. You can send a letter to parents informing them of your plan, and asking for their help gathering some of the information. (The sidebar "Getting Help From Parents" on page 46 gives a sample letter.)

Tell your students that when they begin planning special summer-vacation events, they should ask themselves, "Is this the neatest thing I'm liable to do this summer?" If the answer is "yes" or "maybe," have them keep a journal so they can write down their impressions of the experience while they are still fresh in their memories.

You need to have them capture this experience in other ways as well. You might also tell them to consider taking along the following:

- A sketch pad for drawings, crayoning, or watercolors.
- A camera (Polaroid, pocket camera, digital camera, etc.).
- A tape recorder (for an audio recording).

If they get really ambitious, you might even consider other ways to have them recreate their experiences for their Web documents. For example, have them consider recording and collecting the following:

- Sound effects and music (CDs, tapes, records, live).
- Movies (with a video camera).
- Souvenirs (matchbooks, brochures, magazines, books, etc.).

Getting Started

What do you do when students are ready to get started?

First, have your students write their reports on paper. Then, students should use one of the popular Web authoring programs (we used Claris Home Page) to create their individual multimedia reports about "What I Did Last Summer" that they can save on their own disks, on your computer's hard drive, or on your school's LAN.

Next, have each student create a biographical page that features his or her photo and first name and a short biographical paragraph that does not identify the student's last name or his or her family, community, or school. This ensures that students retain their privacy if their documents get published on the Web.

Finally, after students have created two pages apiece, have them create hot links that, when clicked, link the pages to each other. Figure 1 shows one student's pages.

Then create a classroom table of contents page for the entire class that summarizes the students' theme pages and bio pages and that has a hot link to each student document. Figure 2 shows a portion of our classroom's contents page.

Keep It Simple to be Successful!

Your students' reports can be wonderfully diverse, or you can base them all on a simple template that every student follows. The format is completely up to you. The first time around, you

Figure 1. Brandy's two Web pages.

may want to keep things as simple as possible, and that's okay! The following sections discuss a gallery of different types of student Web documents. Maybe one of these report types will appeal to you.

Choose Your Own Adventure

Perhaps our most unusual format was featured in our third grader, Mike's, page. During the summer, Mike and his family attended a family reunion. Mike reported on the reunion, including a story about one of his cousins hitting a baseball right into a hornet's nest. Mike's story is an excellent model for a teacher to follow when introducing story ideas to his or her students. It has four key elements that make it a winner:

1. It is short.
2. It is exciting—mad hornets attack family picnickers.
3. It is a "choose-your-own-adventure" story. You can respond to the hornet attack in different ways!
4. It has good sound effects.

Teachers will like this type of report because it isn't technically complicated, and students will like it because there is very little writing required. Mike tells his dramatic story in a short, game-like manner with just a couple of lines per screen. Figure 3 shows two of the screens from Mike's story.

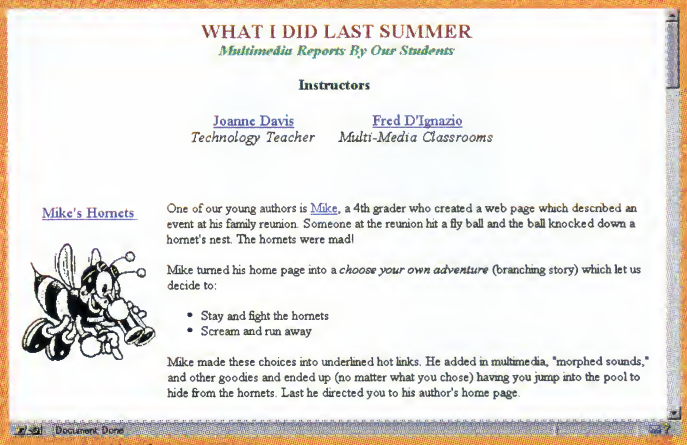


Figure 2. Table of contents page.

Figure 3. Two pages from Mike's choose-your-own-adventure story. If you choose to scream and run for the house on the first page, the second page opens, with a hot link to an audio file of Mike yelling, "Ahhh! Run for your life!"

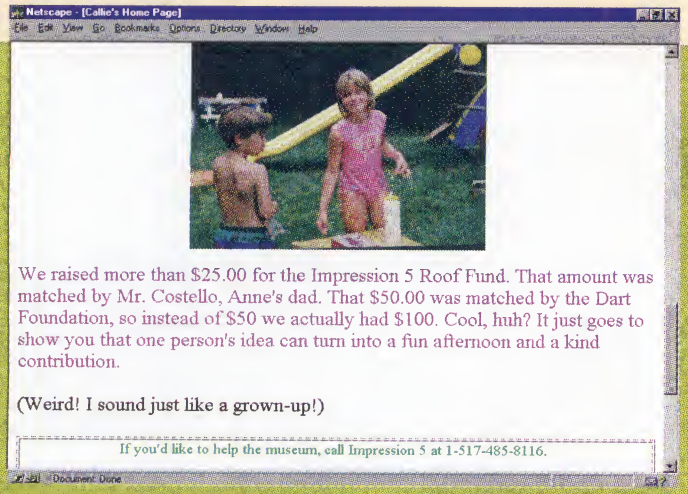


Figure 4. Callie's story about her carnival to raise money for the Impression 5 science museum.

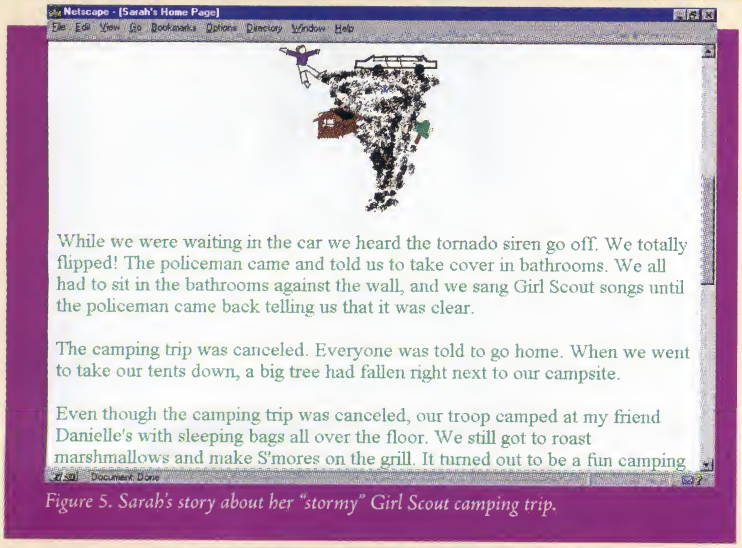


Figure 5. Sarah's story about her "stormy" Girl Scout camping trip.

Plugging Your Favorite Science Museum

A completely different approach was taken by Callie, one of our fourth graders, who decided to base her Web document on her favorite science museum, Impression 5, a hands-on children's museum in Lansing, Michigan. During the previous summer, Callie and her friend Anne decided to hold a carnival to raise funds for Impression 5. Callie's Web document tells the story of how she and Anne put together their carnival (see Figure 4). She finishes the report with a hot link to Impression 5's Web site.

Get a Terrific Interview

The "What I Did Last Summer" Web document by fourth-grade student Sarah was special because it described a dramatic storm that took place during her Girl Scout camping trip. There were thunderstorms in the camp-out area, and her entire troop had to retreat to their den mother, Ruthie's, house to spend the night. Sarah's story became even more dramatic with the exciting cyclone picture drawn by her classmate Tiffany (see Figure 5), and with the "eyewitness interview" from the den mother. (When you click on the hot link, you hear Ruthie describe how frightened even the grown-ups were on that stormy night!)

Make Up a Dramatic Story

To spark our students' creativity, we encouraged them to consider creating fictional stories that were loosely based on real adventures during the summer. Our teenagers particularly liked this idea. Two brothers, Kevin and Marco, wrote science-fiction stories, part fiction and part fact, on how they were kidnapped by aliens. The stories were based on summer trips their family took to visit relatives and to tour Washington, DC. Figure 6 shows pages from both of their reports.

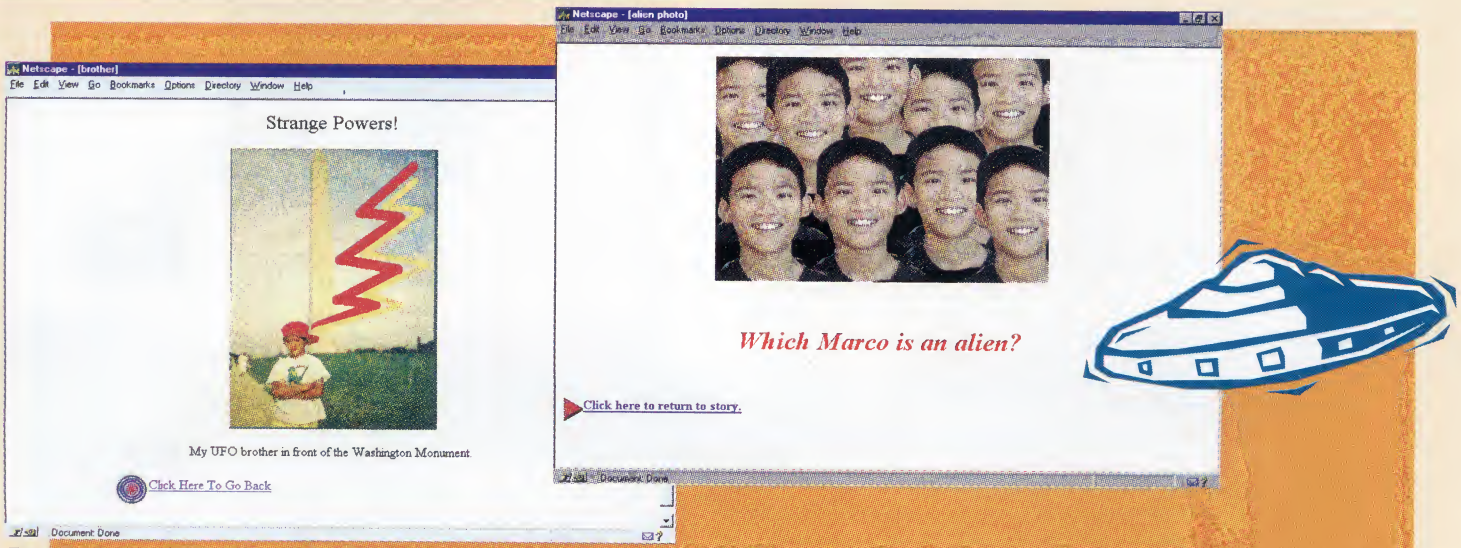


Figure 6. Kevin's and Marco's stories about Marco's "abduction" by aliens. Kevin said his brother Marco returned from the alien spacecraft with strange powers demonstrated in this photo he took of Marco standing in front of the Washington Monument. Marco claimed several clones were made of him before he was returned to earth. According to Marco, all of the clones were "evil Marcos." In this Web document Marco challenges his classmates to pick the original good Marco from all the evil imposters!

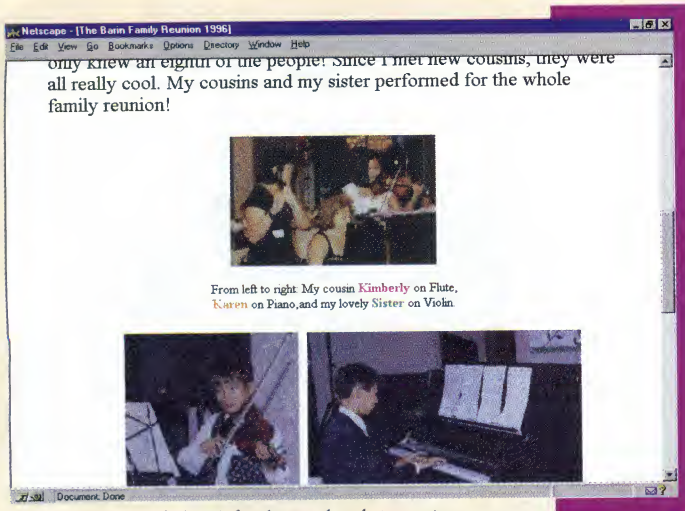
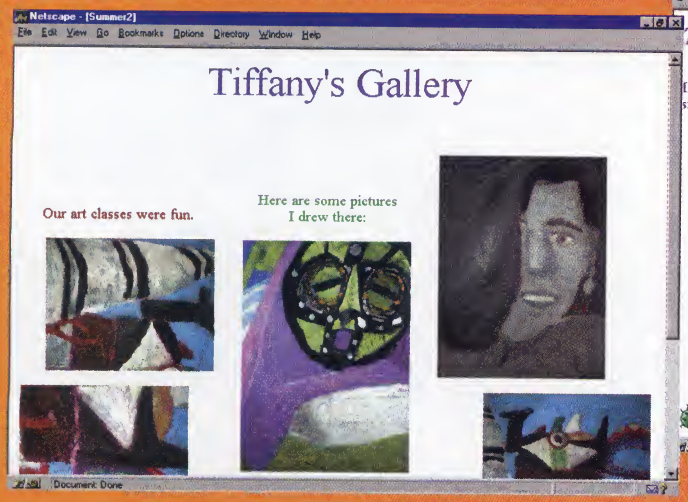


Figure 7. Pictures of Elmer's family recital at their reunion.

A Multimedia Scrapbook

Elmer, a high school student, also went to a family reunion during the summer. He took dozens of photos and recorded lots of interviews with his family members. His Web document was a marvelous multimedia scrapbook that narrated the events at the reunion (see Figure 7). It included photos of family members who attended the reunion and audio hot links that, when clicked, would replay comments from Elmer's family members, many of whom were elderly or from remote parts of the world. As an additional highlight, Elmer inserted a MIDI music file from the Internet that automatically plays each time you open his Web document.



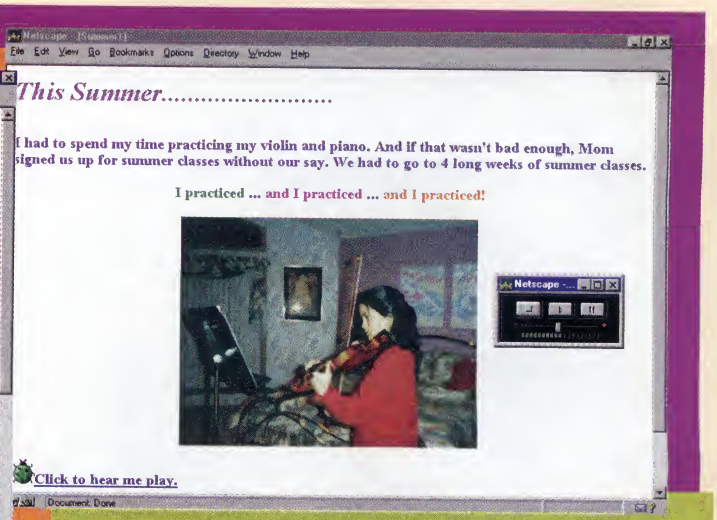


Figure 8. Jessica and Tiffany, who are twin sisters, created some confusion in their Web documents. The picture shows Tiffany practicing her violin, but you hear Jessica playing when you click on the hot link to the audio file.

Original Artwork and Music

Two of our students, Tiffany and Jessica, are talented artists and musicians. They are also twins. Their Web documents (see Figure 8) are galleries of their beautiful artwork, and, when you click the hot links on their page, you hear them playing their violins!

Take Our Ideas and Run With Them!

Our project can be modified any way you like. You might decide instead on reports centered around an important holiday, students' families or pets, or any curriculum unit you plan to cover during the entire school year.

Our intent is to get your creative juices flowing. Your students can create multimedia reports and publish them as Web documents that focus on any subject you choose. The exciting thing is that even though the pages are "Internet ready," they are also exciting to save and publish in a variety of other ways, such as on paper, on disk, on classroom or lab computers, or on LANs.

When you're ready to get started, check out our students' pages on the Internet. Go online, launch your favorite browser (Netscape Navigator, Microsoft Explorer, etc.), and open the following Web address: http://www.tcimet.net/mmclass/summer/CHPTales.htm. If you are planning to try and create Web documents with your students, we invite you to e-mail us with questions or for support.

If you have never done multimedia projects with your students before we have three final tips for you:

1. Use the KISS approach (Keep It Simple to be Successful)!
2. Take "baby steps." Break the process down into small, doable steps.
3. Share responsibility for the project with your students. Do not try this alone!

Remember, this is a great way to have students continue to do reports on important subjects while updating their reports to 21st century standards! ■

Fred D'Ignazio is the editor of the Multimedia Sandbox column. You can reach Fred (dignazio@msen.com) and Joanne Davis (jdavis@okemos.k12.mi.us) at Multi-Media Classrooms, Inc., 1773 Walnut Heights Drive, East Lansing, MI 48823-2495; http://www.tcimet.net/mmclass/.

Getting Help From Parents

If you are lucky and you know which teacher has which students in the fall, you can send home a letter to parents just before the summer vacation and let them know that students will be doing a report on their summertime activities. If not, when school begins, you will want to contact your students' parents in order to enlist their help. The following is an sample "message to parents."

Dear Parents,

This fall your students will be preparing a report entitled "What I Did Last Summer." You probably had to do reports like this when you were in school, too. But this time we're going to try something new. Your child's report will be a multimedia report—using whatever media each student brings in. This might include one or more of the following: text, spoken narration, sound effects, music, photos, their own drawings, and so on. Of course we plan to publish your child's report in the normal, traditional format—that is, paper. But we are also hoping to publish it as a Web document, which your child can save (and bring home) on a disk. Or we might publish their report on our schoolwide intranet (our school's own private Internet that guarantees the safety and security of your child's information). With your permission, we could even publish their reports on the Internet.

As you can see, this report is going to be different. What's more, it'll be a lot of fun. It'll be fun to prepare for, fun to do, and fun to share with family and friends once it's completed.

To help your son or daughter get ready for this report, you need to act as their coach and remind them to do a few important tasks so they can gather materials that they will include in their multimedia report.

First, you need to help your child pick the event, out of everything that happened to them this summer that they will write up as "the big event" for their report.

This event can be almost anything: It might be a family trip you took this summer. It might be a one-day trip to a beach, a lake, or an amusement park. It could be a hiking trip, a bike ride, or even a special movie your child saw. The important thing is that it is a memorable, pleasurable event that they will want to share with their classmates this fall. Remember, there is no need to try to outdo each other or look for some event that will make your child stick out from the crowd. This project is not about "keeping up with the Joneses." The size of the event and the money you spend on it are a lot less important than its emotional and personal value to your child.

Second, we need you to help your child gather some souvenirs from the event that we can scan (that's computer lingo for "capture") into the computer this fall so we can paste the souvenirs into your student's Web page report. Examples of souvenirs might include:

- One or two photos.
- A drawing your child made of the experience.
- A tape recording of a family member or of the student.
- A videotape.
- Photos from a magazine.
- A brochure.
- Ticket stubs.

Any of these things or similar items would be helpful. Scanning is a lot like photocopying: You place an object in on a glass surface; a scanner light moves over it; and you end up with a computer photo instead of a photocopy on paper.

Last, we would like you to encourage your child to write up his or her experience while it is still fresh. The paragraph or more should describe the experience in his or her own words and should try to communicate to classmates why he or she found the experience so special. Here are some questions you might use to get them started:

- What neat thing did you do?
- Where did you do it—did you do it at home, in a different state, or in a different country?
- Who was with you?
- What clothes were you wearing when you did it?
- What kind of weather was it when you did it?
- Was it day or night?
- What did you feel while you were doing it (happy, sad, scared, etc.)?

Tell what happened:

- What was the worst part of the experience?
- What was the best part of the experience?
- Why?
- Do you ever want to do this again?
- If you do it again, what will you do differently?
- Do you recommend this experience for other kids?
- Describe the picture you are sharing about the experience (a caption).
- Describe a second (optional) picture.
- Describe another souvenir that you'd like to include.
- Describe the sound effect/music/voice you might include.
- Do you have anything else you want to tell us about the experience?
- Do you think you'll remember this experience years from now when you're all grown up? If so, why?

You're free to use this list of questions any way you see fit. Cut the list down to make it more manageable, or add new questions in place of the ones we've proposed.

We plan to ask each student to actually create two pages: a story page and a biographical Web page. The story page will tell about the student's special summer event. The bio page will give a short description of the student, accompanied by his or her picture and first name only (for privacy purposes). Also, for security purposes, we never list the student's school, address, phone number, family's last name, or any other identifying information, in case the page is published in a public forum such as the Internet.

Thank you.

Multimedia
On a Shoestring

Imagine your students adding period music to their history reports, turning their short stories into slide shows, and creating original videos about science phenomena they observe. That's the power of multimedia. But wait! Before you say "Not for me, thanks"—because you lack the experience, the resources, or the money to get started with multimedia—give this article a read.

By FRED D'IGNAZIO

Intrigued by multimedia but not convinced it's a possibility for your classroom? You're in the right place—and you're not alone. In this article you'll learn all about a strategy I call "multimedia potluck" that's just the ticket for you and the hundreds of thousands of other teachers out there who want to ride the multimedia wave but don't think you have the resources it takes.

Multimedia potluck is based on the classic children's story *Stone Soup*, in which a beggar comes to a village promising he can make a delicious soup out of water and stones. At first the villagers deride him, but gradually they begin to believe in the vision of

what the soup might become, and they contribute vegetables, meats, and other staples from their own kitchens.

Similarly, through sharing and collaboration, you and your students can create small, low-tech multimedia centers which, like stone soup, will attract additional resources from your school, parents, and community. There are no must-have materials, no waiting for money in the budget. You can set up these stations now—using what you have or can scavenge—starting with the one or two computers you may already have in your classroom. Best of all, you can put your students in charge of gathering the equipment and teaching one another how to use it.

For a quick description of the seven mini-centers—including some of the scavenged equipment that could be in each one—see page 40. And then follow this six-step plan for getting started.

Creating a Mini-Multimedia Centers

Students plan and organize these centers—learning how to use available tools and in turn teaching others. By focusing on one area of multimedia, each child becomes an expert (whether it's at operating a tape player or converting videotapes to computer files). And as these tools become familiar and accessible, students can add them to the repertoire of resources they use every day.

1 Begin by grouping your students into multimedia teams, one for each of the multimedia centers you want to start with (see page 40).

2 Make your own version of the Multimedia Inventory sheet, above. Ask each team to take an inventory of all available equipment and materials in your school community. They'll want to start with your classroom and the school media center. They should also try polling parents who may have unused equipment in closets or who work for companies that may donate old electronic components.

Multimedia Inventory Sheet

Team Members: _____

Multimedia Center: _____

Item/ Equipment#	On Hand/ Make	Days Available: full-time(F), daily(D), weekly(W)	Source: classroom(C), school(S), home(H)

SAMPLE

3 Have each team gather its materials together in a mini-center, such as the corner of the room, a wheeled cart, or a shelf or tabletop. Students should make and display center signs. (If materials aren't yours to use daily, make a list of where and when they are available.)

4 After they experiment with the tools, have teams write recipes—short guides—to using each mini-center. Questions students might try to answer for their classmates include *How can this center help me with the work I do every day? With special projects? What do I have to know to operate these tools? What might be a good way to start out?*

5 Have teams test the recipes with you and their classmates, then publish them in print and in other media (as an instruction tape, a how-to computer file, and so on; see page 40).

FRED D'IGNAZIO, *who appears regularly on PBS and the Discovery Channel as a multimedia instructor, is the founder of Multi-Media Classrooms, Inc., which offers teacher workshops and seminars. Fred is currently constructing Classrooms Without Walls™ in cyberspace. Please visit Multi-Media Classrooms on the World Wide Web at* http://www.tci.east-lansing.mi.us/mmclass/

6 Make time for students to train classmates on techniques and tools.

As students reach Step 6, have them return to Step 3 and inventory new materials as they become available (or are discovered). You'll create a classroom full of teacher apprentices who help transform the raw materials of technology and information into powerful learning.

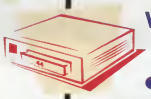
Continued on page 40

Seven Simple Multimedia *Mini-Centers*

The following list is neither mandatory nor exhaustive. It is meant to be suggestive. As students begin to pull together some of the pieces, you can construct customized mini-centers that best fit your needs and those of your students. Hint: Don't try to assemble all the centers at once. Depending on your time, materials, and needs, you might start by setting up one or two centers now, then adding more next year.

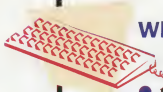
AUDIO CENTER

- tape recorder
- microphone/headphone
- blank audiotapes
- for optional background sounds: additional tape recorder (or CD player, portable stereo, or CD-ROM drive)
- sound-effects tapes (or CDs or CD-ROMs)
- small musical keyboard
- record player/records
- musical instruments/voices



VIDEO CENTER

- video camera
- tripod
- music stand (for displaying signs, rocks, fossils, pictures)
- masking tape (for hanging student work to use for graphics and titles)
- blank videotapes
- microphone/headphones
- optional video backgrounds
- segments taped from CNN Newsroom (and other copyright-free cable)
- educational tapes (from National Geographic, NOVA, Smithsonian, and so on)
- personal videotapes



WRITING CENTER

- word-processing program
- notebooks, pencils, pen, paper
- computer
- printer
- blank disks

GRAPHICS CENTER

- markers, crayons, paints, etc.
- poster board, construction paper, etc.
- paint or graphics programs (such as *HyperStudio, LinkWay, Multimedia Scrapbook, ClarisWorks, KidPix, PrintShop Deluxe,* or *Microsoft Creative Artist*)
- computer
- printer

TELECOMMUNICATIONS CENTER

- computer
- modem (and computer cable)
- phone jack (to outside line)
- phone cable (between modem and jack)
- modem software
- telecommunications service (and local dial-up number)

RESEARCH/CAPTURE CENTER

- books, magazines, newspapers
- note cards, pens, pencils
- computer
- microphone, headphones
- sound card (PC only)
- music stand (for propping up objects to be captured)
- a program such as *HyperStudio* (DOS, Mac, IIGS), *Multimedia Scrapbook* (Windows), or *LinkWay* (DOS)
- cable TV
- VCR/TV and educational tapes
- laserdisc player, laserdiscs
- CD-ROM player/CD-ROM images, sounds, etc.
- hand scanner (Logitech, etc.)
- digital camera (such as QuickTake by Apple or PhotoMan by Logitech)
- *VideoSpigot* (SuperMac) or *ComputerEyes* (Digital Vision) for converting standard video clips into files that you can play on your computer

PUBLISHING CENTER

- computer
- word-processing program or all-in-one software
- *HyperStudio* (DOS, Mac, IIGS), *Multimedia Scrapbook* (Windows), *LinkWay* (DOS), or other multimedia program

To publish on paper:

- printer, paper, cartridges
- labels and card stock for student business cards
- poster paper and construction paper for signs and posters
- book-binding materials (stapler, yarn, ribbon, glue)

To publish on disk:

- blank student disks

To publish on audiotape:

- audiotape recorder
- blank tapes

To publish on videotape:

- video camera/tripod (point camera at computer screen while students narrate script into the microphone)

optional:

- Presenter Plus (or Televeyes) computer-to-video converter
- cables and adapters
- VCR/TV
- blank videotapes (student-portfolio tape or project tapes)

To telepublish over a network:

- Telecommunications Center (above)
- software that lets you attach files to e-mail, including text, sound, image, video, and/or hypermedia files (if you use a commercial service, you're set)
- bulletin board databases (to store and share work within and outside your school)

A MULTIMEDIA PUBLISHING CENTER

FROM SCRATCH (AND SCAVENGE)

BY FRED D'IGNAZIO

You'd probably love to turn your media center into a place for students to use exciting new multimedia tools for research, authoring, and publishing.

If only you had a budget to afford these tools!

Because of the high cost of multimedia paraphernalia such as digital cameras, scanners, multimedia sound cards, LCD panels, CD-ROM drives, and laser disc players, media specialists are often stymied in their plans to create student publishing stations.

Don't despair! You *can* create student publishing stations in your media center. The trick is to think beyond all that expensive multimedia equipment to what you are really seeking: positive student outcomes. Your students can construct their own research, authoring, and publishing stations out of equipment scavenged from around your school and from students' homes. Besides creating usable stations, students will reap other rewards as well.

1. Students will feel ownership and pride as they "invent" their own publishing stations.
2. An atmosphere of sharing, cooperation, and innovation will emerge as students find ways to pool resources and make their stations work.
3. Students from different grades and classes will build a reservoir of expertise together.
4. Those in the multimedia club can share their expertise through demonstrations, open houses, and "cookbooks."
5. Students will build a solid foundation in the components of multimedia: speaking, videotaping, sound effects, graphics, scriptwriting, planning, and producing. After this "pre-multimedia phase, your students will be prepared as you acquire advanced tools that combine several multimedia elements.
6. By learning how to create the text, sounds, images, page layout, and hypermedia links on their simpler "mini-center" workstations, students are preparing to publish online on the World Wide Web.

A RECIPE FOR SUCCESS

Step One: Organize a multimedia club and select a few key student members and parent or teacher helpers.

Step Two: Ask the students to sign a contract as multimedia consultants, authors, or coaches. Make it clear that students are learning so they can act as "service" or "outreach" teams to help everyone in the school.

Step Three: Ask students to conduct an inventory of all equipment that can be "scavenged" from the media center, the school building, and their homes. This involves parents and classroom teachers and encourages students in the multimedia club to cooperate, be resourceful, and plan with scarce resources. *(See page 25 for sample inventory.)*

Step Four: Show students how to group the equipment into publishing mini-centers. Each team is responsible for:

- Locating the appropriate equipment
- Hooking it together
- Making it work
- Writing "recipes" to help other students use the centers to create their own research, authoring, and publishing projects.

The mini-centers can be organized around the edge of the library as a

"publishing wheel." Students can train other students by rotating them along this wheel as "test pilots" for their recipes (tutorials).

Step Five: Ask student teams to construct a digital publishing station as the "hub" station for their publishing wheel. The mini-centers along the edge of the wheel are used to create the multimedia components to feed the hub station. These components include: word processing narratives, poems, stories, quotes from books, images, videotapes, and audiotapes.

Your students may have experience hooking up their Nintendo, Sega, and Genesis game systems. They can use the "picture page" the same way they use Lego Blocks pictures to plug in all the cables. *(See below.)*

As soon as all the cables are plugged in and tested, ask your students to label all the tapes and the switch boxes in case they become unplugged. Certainly it is more work for you to organize students into "construction crews" that assemble their own publishing stations.

On the other hand, you will witness a transformation in these students' attitudes—toward you, your media center, books, and even toward school. In particular, you will see an improved attitude from students who have different learning styles as they find opportunities to make contributions to their teams. TC

Fred D'Ignazio is President of Multi-Media Classrooms, Inc.

MULTIMEDIA CLUB
SAMPLE STUDENT CONTRACT

I _____(name) will work with my fellow students to help make the multimedia club a success. I will do the following to help our media specialist:

(1) Scout out, locate, and assemble new technologies for use in our club.
(2) Manage and operate all equipment safely, fairly, and politely.
(3) Troubleshoot, solve problems, and figure out how to use our equipment for learning, teaching, and authoring.

I will share responsibility with other students for writing up simple guides ("recipes") which help others learn to do useful tasks with the equipment.

I will divide my time between learning the new technologies for myself and sharing what I know with others (club members, media specialist, and parents).

I understand that our media specialist can't figure out new technology alone. He or she needs the help of every student in the club to: (1) Scout out the best technology; (2) Bring it into the club; (3) Set it up and make it work; (4) Teach others how it works; and (5) Manage projects so everyone in the club (including our media specialist) gets experience working with the technology to do useful and cool things.

As a technology helper and coach, I will try to remember what it feels like to be a new learner in an unfamiliar area. I will be polite and use kind words to encourage others to take their first steps into technology. And I will try to keep on schedule in all my personal projects and team projects.

Last, I will remember that my grade is less dependent on my being a technical whiz kid and more on my being a good teacher, friend, and helper.

Student's signature _____

Specialist's signature _____

Parent's signature _____

MULTI-MEDIA WORKSTATION STARTER KIT
CABLES, SWITCHES & ADAPTERS

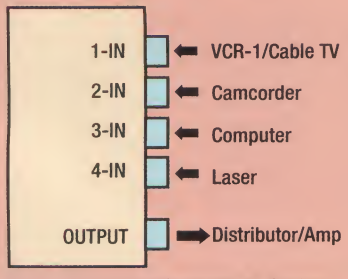
All Items Listed Below Are Available at Your Local Radio Shack!
(Just take this list to a Radio Shack salesperson and have them pick out all the items.)

ITEM	STOCK#	QTY	PRICE	TOTAL
A/V Switch–Stereo	15-1956	2	24.99	49.98
A/V Distributor-Amp	15-1103	1	29.99	29.99
6-Foot VCR A/V Cable	15-1535	2	3.99	7.98
6-Foot Audio Cable	42-2367	4	2.49	9.96
6-Foot Stereo A/V Cable	15-1537	2	7.19	14.38
Y-Adapter (1 Plug to 2 Jacks)	42-2436	2	2.69	5.38
Y-Adapter (1 Jack to 2 Plugs)	42-2435	2	2.79	5.58

ITEM	STOCK#	QTY	PRICE	TOTAL
Microphone & Stand	33-2001	1	11.99	11.99
Phones Plug to 2 Phono Jks (6')	42-2481	2	4.99	9.98
Phono Jack to 1/8-inch Plug	274-378	2	2.49	4.98
Phono Jack to Mini Plug	274-330	2	1.69	3.38
PK2 Phono Plug Adapter	274-320	1	2.73	2.73
PK2 Dual Phono Jacks	274-1553	3	1.39	4.17
TOTAL				**160.48**

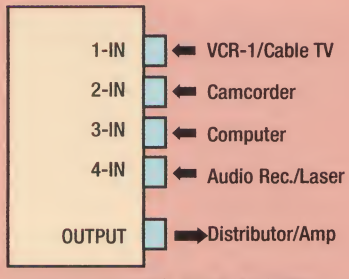
For more information, please contact: Multi-Media Classrooms, Inc.•4121 Okemos Road•Suite 24
Okemos, MI 48864•517-349-1340•FAX: 517-349-3657•E-MAIL: dignazio@msu.edu

Purpose: Lets You Mix Video with Different Audio



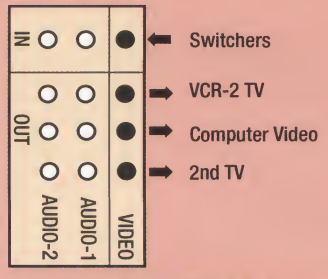
Uses Standard Radio Shack AV Cables

Purpose: Lets You Mix Audio with Different Video



Uses Standard Radio Shack AV Cables

Purpose: Lets You Send Your Multimedia Different Places



Uses Standard Radio Shack AV Cables

CHECKLIST FOR PLANNING AND ASSEMBLING MINI-CENTERS

The following checklist is neither mandatory nor exhaustive. You and your students should use this list along with your home and school inventory lists.

It is up to you to construct customized mini-centers which best fit you, your students, and your classroom. Also, don't try to assemble all the centers at once. Ideally, the Phase One "mini-center" process should take anywhere from one month to an entire semester.

Here are some suggestions for center components.

TYPICAL AUDIO CENTER COMPONENTS

____ Tape recorder
____ Microphone, headphones
____ Blank tapes
____ Optional background sounds:
____ Tape recorder #2 (or CD Player, Boombox, or CD-ROM Player)
____ Sound effects tapes (or CDs, or CD-ROMs)
____ Small musical keyboard
____ Record player and records
____ Live instruments or live voices

TYPICAL VIDEO CENTER COMPONENTS

____ Video camera
____ Tripod
____ Music stand (for signs, pets, rocks, fossils, pictures, etc!)
____ Masking tape (for hanging student artwork on wall to use for video graphics and titles)
____ Blank videotapes
____ Microphone, headphones

Optional video backgrounds:
____ Segments taped from CNN NewsRoom
____ Segments taped from other copyright-free cable
____ Educational tapes such as *National Geographic, NOVA, Smithsonian*
____ Personal videotapes

TYPICAL WRITING CENTER COMPONENTS

____ Notebooks, pencils, pens

Optional:
____ Word processing program
____ Computer
____ Printer
____ Blank disks

TYPICAL GRAPHICS CENTER COMPONENTS

____ Markers, crayons, paints
____ Poster board, construction paper

Optional:
____ Paint program or graphics program *(HyperStudio, LinkWay, Multimedia Scrapbook) (ClarisWorks, KidPix, PrintShop Deluxe, Creative Artist)*
____ Computer
____ Printer

TYPICAL RESEARCH AND CAPTURE CENTER COMPONENTS

____ Books, magazines, newspapers
____ Note cards, pens, pencils

Optional (Low-Cost):
____ Computer
____ Microphone, headphones
____ Sound card (PC only)
____ Music stand (for propping up objects to be captured)
____ *HyperStudio* (Mac/IIgs), *Multimedia Scrapbook* (Windows), *LinkWay* (DOS)

Optional (Higher-Cost):
____ Cable TV
____ VCR/TV and educational tapes
____ Laserdisc player, laserdiscs
____ CD-ROM player, CD-ROM clip images, and sounds
____ Hand scanner such as *Logitech*
____ Digital camera such as Apple's *QuickTake*, Logitech's *PhotoMan*, SuperMac's *VideoSpigot*, or Digital Vision's *ComputerEyes*

TYPICAL TELECOMMUNICATIONS CENTER COMPONENTS

____ Computer
____ Modem and computer cable
____ Phone jack to outside line
____ Phone cable between modem and jack
____ Modem software such as *ZTerm* (Mac), *ProComm*, *ClarisWorks*, *WinTerm*
____ Telecommunications service such as Prodigy, CompuServe, America Online, or a local bulletin board (and local dial-up number!)

TYPICAL LAYOUT AND EDITING CENTER COMPONENTS (OPTIONAL)

____ *HyperStudio* (Mac/IIgs), *Multimedia Scrapbook* (Windows), *LinkWay* (DOS)

Optional:
____ Inspirational software for brainstorming, editing, visualizing, writing

TYPICAL MULTIMEDIA PUBLISHING CENTER COMPONENTS

____ Computer with multimedia program

To publish on paper:
____ Printer, paper, cartridges
____ Labels and card stock for student business cards
____ Poster paper and construction paper for signs and posters

To publish on diskette:
____ Blank student diskettes

To publish on audio tape:
____ Audiotape recorder
____ Blank tapes

To publish on videotape:
____ Video camera and tripod (Point camera at computer screen while students narrate script into the camera microphone.)

Optional:
____ *Presenter Plus (or TelevEyes)* computer-to-video converter
____ Radio Shack cables and adapters
____ VCR
____ TV
____ Blank videotapes (student "portfolio" tapes or "project" tapes)

To telepublish over network:
____ Telecommunications center (see heading above)
____ Software such as *ProComm Plus* that lets you attach sound files, image files, or other files to e-mail
____ Bulletin board databases that store students' work

Optional:
____ *CUSeeMe* Video Conferencing Software (for Mac or PC) on the Internet
____ *Mosaic* (NCSA "Freeware" or commercial version)
____ Multimedia Document and document browser Software

LIVE TUTORIALS

Student teams can present exhibits and tutorials in front of the class. Teachers can tape these presentations and dub the tapes onto the students' videotape "portfolios." These tapes create vivid and dramatic evidence of students' evolving oral communication skills, cooperative learning skills, and technology skills.

Continued on page 25

D'IGNAZIO—
Continued from page 23

MULTIMEDIA INVENTORY

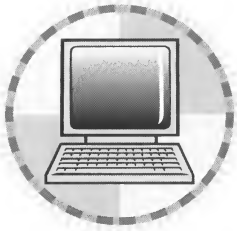
EQUIPMENT AVAILABLE FULL-TIME (F), DAILY (D), OR WEEKLY (W)

(Source: ____Home____School)

School/Student Name_____Phone_____

ITEM/ EQUIPMENT	NUMBER ON HAND	MAKE/KIND AVAILABLE	(F,D, or W)
1. Wheeled Cart	___	_____	___
2. Headphones	___	_____	___
3. Microphone	___	_____	___
4. Record Player	___	_____	___
5. Tape Recorder	___	_____	___
6. Musical Keyboard	___	_____	___
7. Power Strip/Ext.Cords	___	_____	___
8. VCR	___	_____	___
9. TV/Monitor	___	_____	___
10. Camcorder	___	_____	___
11. Pocket Camera	___	_____	___
12. Polaroid Camera	___	_____	___
13. Camera Tripod	___	_____	___
14. CD Player	___	_____	___
15. Radio	___	_____	___
16. Educational Videos	___	_____	___
17. Educational Audiotapes	___	_____	___
18. Records	___	_____	___
19. Audio CDs	___	_____	___
20. Markers, Crayons, etc.	___	_____	___
21. Poster Paper, etc.	___	_____	___
22. Music Stand (Copy Stand)	___	_____	___
23. Computer	___	_____	___
24. Printer	___	_____	___
25. Word Proc. Software	___	_____	___

ITEM/ EQUIPMENT	NUMBER ON HAND	MAKE/KIND AVAILABLE	(F, D, or W)
26. Graphics/Paint Programs	___	_____	___
27. Multimedia Programs	___	_____	___
28. Blank Videotapes	___	_____	___
29. Blank Audiotapes	___	_____	___
30. Blank Diskettes	___	_____	___
31. Computer Paper	___	_____	___
32. Printer Ribbon/Cartrdg.	___	_____	___
33. AA & 9-Volt Batteries	___	_____	___
34. AV Switch Box	___	_____	___
35. AV Cables	___	_____	___
36. AV Cable Adapters	___	_____	___
37. Laser disc Player	___	_____	___
38. Laser discs	___	_____	___
39. CD-ROM Player	___	_____	___
40. CD-ROMs	___	_____	___
41. Video Capture Card/Box	___	_____	___
42. Audio Capture Card/Box	___	_____	___
43. Computer Video to VCR/TV Converter	___	_____	___
44. Modem	___	_____	___
45. Phone Line to Room	___	_____	___
46. Phone Cable	___	_____	___
47. Modem Software	___	_____	___
48. Other	___	_____	___
49. Other	___	_____	___
50. Other	___	_____	___



A MULTIMEDIA PUBLISHING CENTER

FROM SCRATCH (AND SCAVENGE)

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2. An atmosphere of sharing, cooperation, and innovation will emerge as students find ways to pool resources and make their stations work.
3. Students from different grades and classes will build a reservoir of expertise together.
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6. By learning how to create the text, sounds, images, page layout, and hypermedia links on their simpler "mini-center" workstations, students are preparing to publish online on the World Wide Web.

A RECIPE FOR SUCCESS

Step One: Organize a multimedia club and select a few key student members and parent or teacher helpers.

Step Two: Ask the students to sign a contract as multimedia consultants, authors, or coaches. Make it clear that students are learning so they can act as "service" or "outreach" teams to help everyone in the school.

Step Three: Ask students to conduct an inventory of all equipment that can be "scavenged" from the media center, the school building, and their homes. This involves parents and classroom teachers and encourages students in the multimedia club to cooperate, be resourceful, and plan with scarce resources. *(See page 22 for sample inventory.)*

Step Four: Show students how to group the equipment into publishing mini-centers. Each team is responsible for:

- Locating the appropriate equipment
- Hooking it together
- Making it work
- Writing "recipes" to help other students use the centers to create their own research, authoring, and publishing projects.

The mini-centers can be organized around the edge of the library as a "publishing wheel." Students can train other students by rotating them along this wheel as "test pilots" for their recipes (tutorials).

Step Five: Ask student teams to construct a digital publishing station as the "hub" station for their publishing wheel. The mini-centers along the edge of the wheel are used to create the multimedia components to feed the hub station. These components include: word processing narratives, poems, stories, quotes from books, images, video and audiotapes.

Your students may have experience hooking up their Nintendo, Sega, and Genesis game systems. They can use the "picture page" the same way they use Lego Blocks pictures to plug in all the cables. (See below.)

As soon as all the cables are plugged in and tested, ask your students to label all the tapes and the switch boxes in case they become unplugged. Certainly it is more work for you to organize students into "construction crews" that assemble their own publishing stations.

On the other hand, you will witness a transformation in these students' attitudes—toward you, your media center, books, and even toward school. In particular, you will see an improved attitude from students who have different learning styles as they find opportunities to make contributions to their teams.

Fred D'Ignazio is President of Multi-Media Classrooms, Inc.

MULTIMEDIA CLUB SAMPLE STUDENT CONTRACT

I _____ (name) will work with my fellow students to help make the multimedia club a success. I will do the following to help our media specialist:

(1) Scout out, locate, and assemble new technologies for use in our club.
(2) Manage and operate all equipment safely, fairly, and politely.
(3) Troubleshoot, solve problems, and figure out how to use our equipment for learning, teaching, and authoring.

I will share responsibility with other students for writing up simple guides ("recipes") which help others learn to do useful tasks with equipment.

I will divide my time between learning the new technologies for myself and sharing what I know with others (club members, media specialist, and parents).

I understand that our media specialist can't figure out new technology alone. He or she needs the help of every student in the club to: (1) Scout out the best technology; (2) Bring it into the club; (3) Set it up and make it work; (4) Teach others how it works; and (5) Manage projects so everyone in the club (including our media specialist) gets experience working with the technology to do useful and cool things.

As a technology helper and coach, I will try to remember what it feels like to be a new learner in an unfamiliar area. I will be polite and use kind words to encourage others to take their first steps into technology. And I will try to keep on schedule in all my personal projects and team projects.

Last, I will remember that my grade is less dependent on my being a technical whiz kid and more on my being a good teacher, friend, and helper.

Student's signature _____

Specialist's signature _____

Parent's signature _____

MULTI-MEDIA WORKSTATION STARTER KIT

CABLES, SWITCHES & ADAPTERS

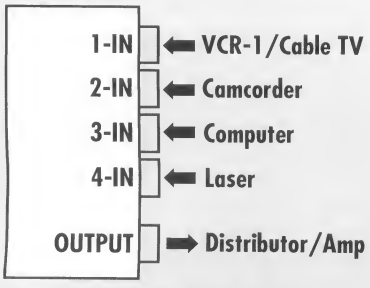
All Items Listed Below Are Available at Your Local Radio Shack!
(Just take this list to a Radio Shack salesperson and have them pick out all the items.)

ITEM	STOCK#	QTY	PRICE	TOTAL
A/V Switch-Stereo	15-1956	2	24.99	49.98
A/V Distributor-Amp	15-1103	1	29.99	29.99
6-Foot VCR A/V Cable	15-1535	2	3.99	7.98
6-Foot Audio Cable	42-2367	4	2.49	9.96
6-Foot Stereo A/V Cable	15-1537	2	7.19	14.38
Y-Adapter (1 Plug to 2 Jacks)	42-2436	2	2.69	5.38
Y-Adapter (1 Jack to 2 Plugs)	42-2435	2	2.79	5.38

ITEM	STOCK#	QTY	PRICE	TOTAL
Microphone & Stand	33-2001	1	11.99	11.99
Phones Plug to 2 Phono Jks (6')	42-2481	2	4.99	9.98
Phono Jack to 1/8-inch Plug	274-378	2	2.49	4.98
Phono Jack to Mini Plug	274-330	2	1.69	3.38
PK2 Phono Plug Adapter	274-320	1	2.73	2.73
PK2 Dual Phono Jacks	274-1553	3	1.39	4.17
TOTAL				160.48

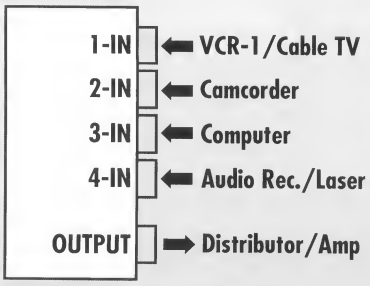
For more information, please contact: Multi-Media Classrooms, Inc. ▲ 4121 Okemos Road ▲ Suite 24
Okemos, MI 48864 ▲ 517-349-1340 ▲ FAX: 517-349-3657 ▲ E-MAIL: dignazio@msu.edu

Purpose: Lets You Mix Video with Different Audio



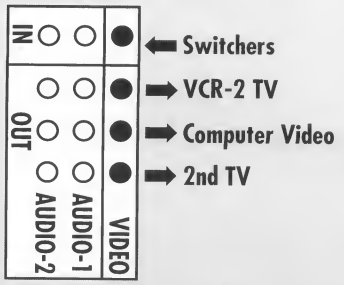
Uses Standard Radio Shack AV Cables

Purpose: Lets You Mix Audio with Different Video



Uses Standard Radio Shack AV Cables

Purpose: Lets You Send Your Multimedia Different Places



Uses Standard Radio Shack AV Cables

CHECKLIST FOR PLANNING AND ASSEMBLING MINI-CENTERS

The following checklist is neither mandatory nor exhaustive. You and your students should use this list along with your home and school inventory lists.

It is up to you to construct customized mini-centers which best fit you, your students, and your classroom. Also, don't try to assemble all the centers at once. Ideally, the Phase One "mini-center" process should take anywhere from one month to an entire semester.

Here are some suggestions for center components.

TYPICAL AUDIO CENTER COMPONENTS

____ Tape recorder
____ Microphone, headphones
____ Blank tapes

Optional background sounds:
____ Tape recorder #2 (or CD Player,
____ Boombox, or CD-ROM Player)
Sound effects tapes (or CDs, or CD-ROMs)
____ Small musical keyboard
____ Record player and records
____ Live instruments or live voices

TYPICAL VIDEO CENTER COMPONENTS

____ Video camera
____ Tripod music stand
____ Masking tape
____ Blank videotapes
____ Microphone, headphones

Optional video backgrounds:
____ Segments taped from CNN NewsRoom
____ Segments taped from other copyright-free cable
____ Educational tapes such as *National Geographic, NOVA, Smithsonian*
____ Personal videotapes

TYPICAL WRITING CENTER COMPONENTS

____ Notebooks, pencils, pens

Optional:
____ Word processing program
____ Computer
____ Printer
____ Blank disks

TYPICAL GRAPHICS CENTER COMPONENTS

____ Markers, crayons, paints
____ Poster board, construction paper

Optional:
____ Paint program or graphics program *(HyperStudio, LinkWay, Multimedia Scrapbook) (ClarisWorks, KidPix, PrintShop Deluxe, Creative Artist)*
____ Computer
____ Printer

TYPICAL RESEARCH AND CAPTURE CENTER COMPONENTS

____ Books, magazines, newspapers
____ Note cards, pens, pencils

Optional (Low-Cost):
____ Computer
____ Microphone, headphones
____ Sound card (PC only)
____ Music stand (for propping up objects to be captured)
____ *HyperStudio* (Mac/IIgs), *Multimedia Scrapbook* (Windows), *LinkWay* (DOS)

Optional (Higher-Cost):
____ Cable TV
____ VCR/TV and educational tapes
____ Laserdisc player, laserdiscs
____ CD-ROM player, CD-ROM clip images, and sounds
____ Hand scanner such as *Logitech*
____ Digital camera such as Apple's *QuickTake,* Logitech's *PhotoMan,* SuperMac's *VideoSpigot,* or Digital Vision's *ComputerEyes*

TYPICAL TELECOMMUNICATIONS CENTER COMPONENTS

____ Computer
____ Modem and computer cable
____ Phone jack to outside line
____ Phone cable between modem and jack
____ Modem software such as *ZTerm* (Mac), *ProComm, ClarisWorks, WinTerm*
____ Telecommunications service such as Prodigy, CompuServe, America Online, or a local bulletin board (and local dial up number!)

TYPICAL LAYOUT AND EDITING CENTER COMPONENTS *(OPTIONAL)*

____ *HyperStudio* (Mac/IIgs), *Multimedia Scrapbook* (Windows), *LinkWay* (DOS)

Optional:
____ Inspirational software for brainstorming, editing, visualizing, writing

TYPICAL MULTIMEDIA PUBLISHING CENTER COMPONENTS

____ Computer with multimedia program

To publish on paper:
____ Printer, paper, cartridges
____ Labels and card stock for student business cards
____ Poster paper and construction paper for signs and posters

To publish on diskette:
____ Blank student diskettes

To publish on audio tape:
____ Audiotape recorder
____ Blank tapes

To publish on videotape:
____ Video camera and tripod (Point camera at computer screen while students narrate script into the camera microphone.)

Optional:
____ *Presenter Plus (or TelevEyes)* computer-to-video converter
____ Radio Shack cables and adapters
____ VCR
____ TV
____ Blank videotapes (student "portfolio" tapes or "project" tapes)

To telepublish over network:
____ Telecommunications center (see heading above)
____ Software such as *ProComm Plus* that lets you attach sound files, image files, or other files to e-mail
____ Bulletin board, databases that store students work

Optional:
____ *CUSeeMe* Video Conferencing Software (for Mac or PC) on the Internet
____ *Mosaic* (NCSA "Freeware" or commercial version)
____ Multimedia Document and document browser software

LIVE TUTORIALS

Student teams can present exhibits and tutorials in front of the class. Teachers can tape these presentations and dub the tapes onto the students' videotape "portfolios." These tapes create vivid and dramatic evidence of students' evolving oral communication skills, cooperative learning skills, and technogy skills.

MULTIMEDIA INVENTORY

EQUIPMENT AVAILABLE FULL-TIME (F), DAILY (D), OR WEEKLY (W)

(Source: ____Home ____School)

School/Student Name_____ Phone_____

ITEM/ EQUIPMENT	NUMBER ON HAND	MAKE/KIND AVAILABLE	(F, D, or W)
1. Wheeled Cart			
2. Headphones			
3. Microphone			
4. Record Player			
5. Tape Recorder			
6. Musical Keyboard			
7. PowerStrip/ Ext.Cords			
8. VCR			
9. TV/Monitor			
10. Camcorder			
11. Pocket Camera			
12. Polaroid Camera			
13. Camera Tripod			
14. CD Player			
15. Radio			
16. Educational Videos			
17. Educational Audiotapes			
18. Records			
19. Audio CDs			
20. Markers, Crayons, etc.			
21. Poster Paper, etc.			
22. Music Stand (Copy Stand)			
23. Computer			
24. Printer			
25. Word Proc. Software			

ITEM/ EQUIPMENT	NUMBER ON HAND	MAKE/KIND AVAILABLE	(F, D, or W)
26. Graphics/ Paint Programs			
27. Multimedia Programs			
28. Blank Videotapes			
29. Blank Audiotapes			
30. Blank Diskettes			
31. Computer Paper			
32. Printer Ribbon/ Cartrdg.			
33. AA & 9-Volt Batteries			
34. AV Switch Box			
35. AV Cables			
36. AV Cable Adapters			
37. Laserdisc Player			
38. Laserdiscs			
39. CD-ROM Player			
40. CD-ROMs			
41. Video Capture Card/Box			
42. Audio Capture Card/Box			
43. Computer Video to VCR/TV Converter			
44. Modem			
45. Phone Line to Room			
46. Phone Cable			
47. Modem Software			
48. Other			
49. Other			
50. Other			

Illumination—It's Elementary!

by Fred D'Ignazio

Multimedia runs the risk of becoming more image than message. But when students create their own multimedia programming using the new authoring software, it's the words that win.

Everywhere we see predictions that we are entering a postmodern, post-Gutenburg world in which knowledge will be gained and shared without the need to read or write. Is this true? Are reading and writing dead? Are CDs (CD-ROMs) going to replace books the way they replaced record-store LPs? Recently I had an experience that makes me wonder if the reports of the death of books are premature. Maybe books aren't dead after all. Maybe reading and writing still have a purpose, even in an electronic, real-time, multimedia world.

The Computer as Theater

I was recently asked by EduQuest to present their *Illuminated Books and Manuscripts* product at a recent EduQuest Executive Conference in Atlanta, Georgia. I have watched the way people take this magnificent product—a collection of multimedia illuminated works (Shakespeare's *Hamlet*, *Black Elk Speaks*, Martin Luther King's 1963 *Letter from a Birmingham Jail*, Tennyson's poem *Ulysses*, and the *Declaration of Independence*)—and become humbled. The product is so stunning, so overwhelming, that you feel timid and uncreative in comparison. Watching EduQuest's *Illuminated Books* is a little like watching a Broadway musical like Andrew Lloyd Webber's "Starlight Express," or gazing in awe as Michael Jordan swoops through the air toward the basket in a giant sports arena, or staring in wonder at the Grand Canyon.

But this feeling is going to get us into trouble. The new media will soon turn the computer into a one-ring Barnum & Bailey's Circus, an electronic version of Alice's looking glass, a one-stage theater featuring multisensory fireworks to delight and mesmerize the mind. Multimedia will be produced by our foremost computer whizzes, graphics artists, musicians, and moviemakers spending millions of dollars per product. It will all appear on a single screen to hypnotize, seduce, and entertain us. It has the very real potential (once linked to the TV via the new 500-channel digital cable systems) to turn us all into willing hyper couch potatoes.

It Doesn't Have to Be That Way.

The new media can be more than a spectator sport for millions of virtual-reality armchair voyeurs and jocks. It's going to be cheap, fast, and easy to use—for adults and kindergartners alike. And it doesn't have to be crafted by the likes of Lucas, Spielberg, and Schwartzenegger. It can be created by toddlers, teens, teachers—by you and me. The new media can be more than an electronic spectacle. It's an opportunity for all of us to be artists, musicians, sculptors, composers—and readers and writers!

When EduQuest approached me to demonstrate its product, the last thing I wanted to do was show it like a "movie." So I called up a fourth grade teacher, Bill Lang, and asked him if he could organize a field trip to my studio to see how his nine-year-old kids would do illuminating their own original works using Eduquest's *Illuminated Books and Manuscripts* product. Bill said yes, and the rest is history.

A Letter to President Clinton

I have now presented the fourth graders' illuminated works to hundreds of educators from all over America and Canada. On giant nine-foot screens with a PA system carrying the children's digitized voices, I have demonstrated their letters to our newly inaugurated President and their poems about everyday life, including Grover, Charlie Brown, and ice cream. The children's multimedia illuminations are extraordinary. They taped segments of President Clinton's inaugural address and keyed them to words in their own letters. They captured clips of Maya Angelou's magnificent inaugural-day poem, "On the Pulse of Morning," and replayed her rich voice ringing through the crisp, cold, Capitol air.

But the high point is the children's own words—both written and spoken. The children rehearsed their works collaboratively and after much discussion, and read them proudly and exceptionally into the computer microphone. And the words themselves are exceptional—free of sloppy misspellings, immature constructions, and embarrassing

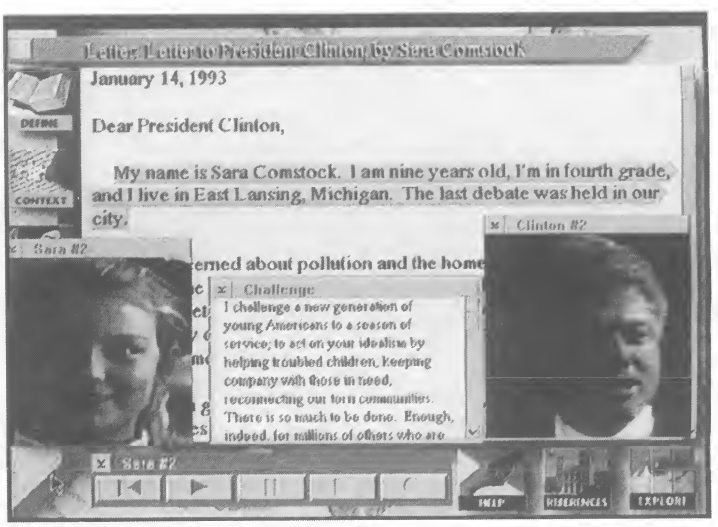


Figure 1.

imperfections. The children had been writing all year long under Mr. Lang's guidance. They wrote every day in class and for homework. They wrote journals, biographies, poems, letters, and short stories. And it shows. Beneath all the multimedia illumination, it shows!

And it reminds me that the basis for all our thinking is words. The little voice that speaks to each of us in the hollows of our minds is a voice of words—not images, not pictures, not music. Those too, if we're lucky. But first of all, words.

And what will we be like if we lose the primacy of words? What will happen if we each think in a different, multimedia tongue—some of us in images, some in sounds? What will be the result if all linguistic (or word-oriented) thinking is replaced by this multimedia Babel?

Maybe writing, after all, will survive. And writing doesn't have to be the end of our young authors' creative expression. Children can use their words as a launch pad to illuminate the ideas that they sketch out with their words. They can link their words to images, music, spoken words, movies, etc. to illustrate and communicate rich and complicated ideas that even fourth graders have demonstrated they have. Writing is the basis for thinking. Bill Lang's young writers have shown us some *beautiful* thinking through their multimedia illuminations, but most of all, through the spoken and written words that they eloquently created.

The Text of the Future

One of the shrewdest observers of our times is Dr. Shoshonna Zuboff, a Harvard business professor whose lifelong passion is studying people at work and writing about the transformation in the workplace created by our smart machines. According to Zuboff, one of the key developments in all organizations brought about by computers is the real-time "window" on the organization created by the computer screen. Any worker can now look into the organization's most detailed inner functions and play a role in making the organization do its job better.

Zuboff calls the information on the screen a "scrolling super-text," a kind of movie, that, as it rolls by, plays out the drama and melodrama of the organization's key actors—its income, its expenses, its products, its supplies, its processes, its technologies, its people. According to Zuboff, the most successful organizations in the future will be those who "informate"—who open this window to their employees and then teach them how to read and write in super-text, the meta-language of the future.

A Multimedia Book of the Future

Watching Mr. Lang's fourth graders operate EduQuest's *Illuminated Books* and *Manuscripts,* I had a feeling that I was watching the growth of this new "super-text literacy." The *Illuminated Books* product is really a multimedia book of the future that allows a reader to click on various "Global Reader" tools in order to explore and understand a work. A reader, for example, can click on "Define" to get an oral, graphic, and written definition of key words and terms used in the work. They can click on "Context" or on "Link" to gain a deeper insight into the rich issues and themes that resonate within the work. Or they can click on "Interpret" and hear dramatic readings of the work by famous poets, actors, or orators; see graphics and video clips; or hear analysts attack or support the work with eloquent opinions and critiques.

Mr. Lang's fourth graders quickly got the hang of these "reader" tools by exploring two short works—King's "Letter from a Birmingham Jail," and Tennyson's "Ulysses." The position of children and adults at the workstation told the whole story. After only one afternoon of learning how to "drive" the *Illuminated Books* product, the children switched from the back seats to the driver's seat where they took over the program's controls. It was a slightly painful experience for us adults. We began the afternoon operating the mouse and asking the kids where we should click next. Midway through the journey, the children were directing us to point and click so fast that we adults were getting nervous and disoriented. So we did the most graceful thing we could do: we turned over the steering wheel (and the gas pedal!) to the kids. The four girls—Attallah Price, Sara Comstock, Mariko Hachiya, and Dana Clifford—swarmed over the computer. And then they really took off!

The Media Manager

On the second afternoon, we switched from the role of "reader" to "author." We taught the students how to change from "Explore" mode to "Create" mode. The students took their ASCII letters and poems on their classroom diskettes and loaded them into the *Illuminated Books and Manuscripts* program. It was amazing to see the computer screen title of "Black Elk Speaks" and "The Declaration of Independence" replaced by "A Letter to President Clinton by Mariko Hachiya," and "Ice Cream, a poem by Dana Clifford."

Once their documents were loaded into the product, it was time for the students to actually "illuminate" their works. To do this, they switched to "Analyze" mode, clicked on a word or phrase in their work, and dragged a colored window around it. This created a hyptertext "button" or "trigger" that would summon a sequence of media events when a reader clicked it, back in the "Explore" (browse or read) mode.

Next, when the girls clicked on their words in "Analyze" mode, they called up the Media Manager. The Media Manager is like a digital editing suite. The kids could take "VTGA"—video, text, graphics, and audio events—that they had captured in preparation for this step and link them to their button or trigger back in their document. They began by creating media events one at a time and linking them to colored icons on the computer screen. They named each icon and then when all the icons were assembled in a "Library Reel" they could select icons for a particular button by dragging them into a "Clip Reel" that functioned as a scratchpad or clipboard. The final step was to drag the icons down to the "Media Reel" in the order that they would appear after a reader clicked on a particular button.

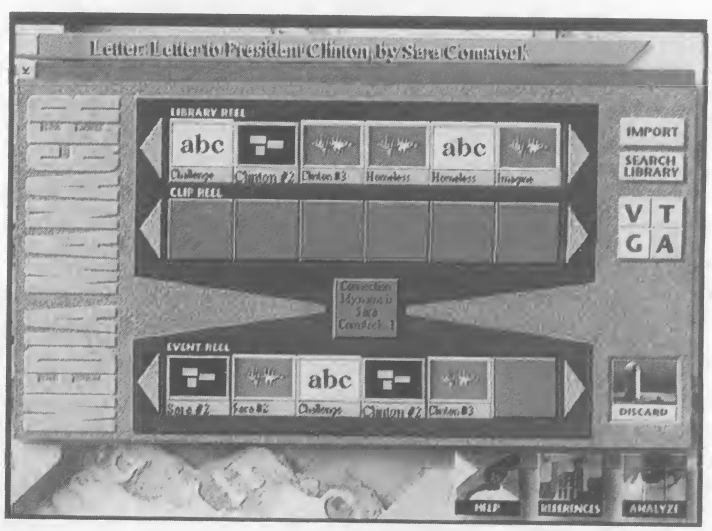


Figure 2.

Multimedia Footnotes

To get ready for this stage, the girls had captured a wealth of media events, including:

- Their own digitized photos (using a Logitech Hand Scanner)
- Their own digitized voices (using a Radio Shack mike and a digital audio card on the computer).
- Digitized music from a CD that reflected the themes in their works.
- Their written definitions, descriptions, and transcripts of speeches, typed in at the keyboard and stored as Text Events on the Library Reel.
- Scanned images of President Clinton from CNN (recorded on a video-digitizing card).
- President Clinton's Inaugural Address recorded off CNN and digitized using the computer's audio card.
- Audio tapes digitized into the audio card.

After creating each media event, the *Illuminated Books* product led the girls into a special worksheet screen that required them to thoroughly document the source of each event. They had to enter all copyright information, the author, publisher, date of publication, key themes and keywords connected to each event. It was as if they were building library cards for an automated card catalog. It was extremely impressive watching the girls hunting through their sources—books, magazines, videotapes, audio tapes, dictionaries, and so forth. to find all the required information that the program prompted them for. Mr. Lang and I felt it went a long way toward making the kids' use of commercial media legal and ethical, and it helped them become more responsible multimedia authors. Also, it was a source of great pride to the kids to attach footnotes and copyright notices to all the media events that they had created themselves!

"Voted ... Choosing a Leader"

Last, the kids saved all their media events and all their media links, then returned to the document itself. After switching to "Explore" mode they tested their buttons. For example, to explore word definitions that they themselves had invented, they clicked on the "Global Reader" tool labelled "Define." Instantly all the words they had defined in each of their works turned yellow. When they clicked on one of these "hot spots" they triggered the stream of media events associated with that word. So, for example, if they clicked on the word "voted" in Attallah Price's letter to President Clinton, a text box with Attallah's definition appeared on the screen, and they could hear Attallah reading her definition aloud: "Voted ... Choosing a leader." Also appearing on the screen was a little "zapper"—a digital tape recorder panel with buttons allowing a reader to instantly rewind the audio, pause the audio, fast forward or stop the audio. This feature allows the reader to review parts of an oral recitation or pause a presentation midway to spark students' questions and discussion.

Illuminating on a Shoestring

Next month we'll look at an alternative to *"Illuminated Books and Manuscripts"* for those of us who have to live within a tight budget. The products that let you illuminate inexpensively are *MediaText* (a multimedia word processor from Wings for learning), *ScanMan* (a hand scanner), and *Catchword Pro* (optical character recognition software) from Logitech. The screens you build in *MediaText* are not as elegant as those in the EduQuest product, but children can create their own illuminated works or illuminate books, magazines, and works in a library at a fraction of the cost. And the results are highly satisfying.

[Fred D'Ignazio, Multimedia Classrooms, Inc., 4121 Okemos Rd., Ste. 24, Okemos, MI 48864.]

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Integrating the Work Environment of the 1990s into Today's Classrooms

by FRED D'IGNAZIO, Director
Teacher Explorer Center, East Lansing Public Schools
East Lansing, Mich.

To fit the workplace of the 21st century, American industry hopes to recruit a new kind of worker, one who is eminently trainable. These workers will not need to know everything up front—nor will they be expected to. Instead, they will come with skills that make them good learners. Those skills will include:

- a strong grounding in basic skills, including oral and written communication skills, plus practical math, estimation and computational skills;
- the ability to cope with new technologies and the use of technology as a tool to achieve organizational goals;
- the ability to take responsibility for learning;
- the ability to promote learning on the part of peers and colleagues;
- the ability to work cooperatively in a high-performance team environment; and
- the ability to deal with fluid, evolving and ambiguous situations in which problems must be solved given little time and using incomplete information and experience.

Workers of this calibre will not just magically pop out of nowhere. They will only emerge from classrooms in which they have spent years practicing and refining the necessary skills.

Teachers as Leaders

What this means to teachers is that we have entered an era in which their roles must change significantly. Not something under anyone's control, these forces for change are impersonal, pervasive and societywide.

But although change is inevitable, all teachers should be given the opportunity to control the direction and pace of change in their own classroom and own career. Furthermore, each teacher should have the opportunity to become a leader—a visionary, a scout, a champion—for change that improves the quality of their working environment, makes them more successful in teaching their students, and elevates their status in the eyes of their community and the educational establishment.

Multimedia Offers Opportunity

Fortunately, technology itself is offering teachers this opportunity by redefining the curriculum they are required to teach. In this decade, curricular "knowledge" will be transformed as the publishing, broadcasting and communication industries converge toward a common digital standard. Knowledge "carriers" that were once quite separate—radio, TV, motion pictures, telecommunications, magazines, newspapers, data processing and the performing arts—will converge and overlap. Out of this will emerge new hybrid representations of curricular knowledge—through multimedia publishing, multimedia data processing, and so on.

> Educators can assemble a multimedia learning center from equipment already at most schools.

At the same time, new multimedia-oriented products will become available to individuals as new tools for personal communication. The scope of desktop publishing is already expanding to include "documents" that combine photographic images, human voices, music, sound effects, full-motion video and computer graphics, as well as words and numbers.

Teachers who embrace this technology early have a unique opportunity to become pioneers in a remarkable new learning environment in which *students can reconstruct knowledge in a multimedia format.* Thus, today's "talk and text" classroom environment will evolve into an exciting, studio-like arena in which

(continued on page 96)

student producers create curricular videos, electronic slide shows, video book reports, infographics, multimedia term papers and a multitude of other materials. Difficult, dry areas of the curriculum will come alive as students translate them into vivid multimedia presentations.

Do-It-Yourself Platform

Educators who see the possibilities for student-produced multimedia learning don't have to wait for some far-off future. They can begin now. They can bring the multimedia publishing environment of the 21st century into today's classroom. With a little bit of creativity, educators can assemble a multimedia learning center from individual components scavenged from equipment already found at most schools.

> The scope of desktop publishing is already expanding.

Teachers are ingenious improvisers and scavengers and they can use these skills to work with their students and track down everything they need. Such equipment may include a personal computer, a VCR, a TV, a video camera, an audio tape recorder, a videodisc player, a record player, and an electronic keyboard. Put together correctly, this equipment can form a multimedia platform capable of publishing video biographies, multimedia science projects, electronic field trips and all sorts of other innovative and exciting presentations.

Sharing Responsibility

None of this will happen, however, unless teachers share some of the responsibilities for teaching and learning with their students. A multimedia learning environment facilitates this approach because everyone learns from each other.

> In a multimedia learning environment everyone learns from each other.

Under this new environment, a teacher acts as a process and knowledge specialist. Students, especially at early ages, are particularly handy around new technologies and at figuring out ingenious ways to explore critical subjects in the curriculum using those technologies. Working together within this new learning environment, teachers and students become teams of "knowledge explorers" who translate textbook knowledge into new, exciting multimedia presentations.

If education is going to succeed at preparing students for the workplace of the 1990s and beyond, its administrators and teachers must create an environment resembling that workplace—and technology is only one ingredient. Opportunities comprise the rest of the equation—opportunities for students to take responsibility for their own learning and to become producers of their own knowledge. Students must spend time working in collaborative teams and be put into situations where they can explore, muck around, and think critically and cooperatively in order to solve problems and accomplish tasks.

Such a classroom models the work environment of the future, and in it teachers have a dual role—as leaders of and as collaborators with their students. ■

Educators interested in the Teacher Explorer Center, which offers training in multimedia technologies to all teachers, may contact the center at 509 Burcham Dr., East Lansing, MI 48823.

Fred D'Ignazio *has created the multimedia classroom described in this article at the Teacher Explorer Center (TEC), a teacher training center located in East Lansing, Mich. Serving as a Model Classroom of the Future for the state of Michigan, which is expanding the center next year, TEC will also serve as a "buddy" for a similar program in the Detroit Public School district during the 1990/91 school year.*

Using HyperStudio on the Internet

Chef Fred's Favorite Recipes

Classroom teachers who want to show their students how to use multimedia in their projects are sure to at least consider using HyperStudio. This versatile program has been recently enhanced with many more capabilities. In this month's Multimedia Sandbox, regular chef Fred D'Ignazio sets his table with some of the best dishes he's found in the last few months. He also lists "recipe" sites so you can be sure to taste the dishes yourself and see how the individual cooks pulled together their ingredients.

By Chef Fred D'Ignazio

HyperStudio is the most popular multimedia program in schools. With this simple but powerful program, thousands of classrooms around the world are publishing their own student-authored multimedia stacks. Students are producing HyperStudio book reports, science projects, biographies, portfolios, exhibitions, electronic field trips, resumes, and "e-cards" (electronic business cards) on their classroom and family computers.

This burst of student publishing is stupendous. But don't you wish your students could publish their HyperStudio stacks on the Internet? Well, now they can.

HyperStudio and the Internet can be woven together in two ways: (1) by linking from HyperStudio to the Internet, and (2) by linking from the Internet to HyperStudio.

In the first method, create a hypertext link in HyperStudio that launches your browser and sends it to the embedded URL address, just like a normal Web page hot link.

In the second method, create a hot link on a Web page that "plays" the stack by launching either the HyperStudio player on your hard drive or network as a "helper" application for your browser or the HyperStudio plug-in (go to http://www.hyperstudio.com/lab/plugin.html to get this plug-in for your Mac or PC browser).

HyperStudio's Many Capabilities

HyperStudio can do a lot more than simply publish its stacks to the Internet. Here's what else you can do with it: (1) control Netscape Navigator, (2) open HyperStudio stacks by using Netscape, (3) create an "Internet on a disk," and (4) make an Internet sound button.

Controlling Netscape Navigator with HyperStudio. The recipe for controlling Netscape with HyperStudio can be found at http://www.mudpie.org/hyperstudio/NetOpen.htm. This

recipe has been tested with Netscape 3.x and should also work with Internet Explorer 3.x and above.

Opening HyperStudio Stacks Using Netscape Navigator. The recipe for opening HyperStudio stacks with Netscape can be found at http://www.mudpie.org/hyperstudio/StkOpen.htm. Again, this recipe has been tested with Netscape Navigator 3.x, and it should work with Internet Explorer 3.x and above.

Creating an "Internet on a Disk" Using HyperStudio. This recipe is useful if your school has only a few connected Internet computers that are not accessible to all students. It gives you a strategy for downloading Web pages from the Internet to a student or teacher disk and later simulating the Internet (using a disk-based intranet) offline on any computer that runs Netscape Navigator and HyperStudio (or HyperStudio Player). You can find the recipe at http://www.mudpie.org/hyperstudio/Intranet.htm. This recipe also has been tested with Netscape Navigator 3.x and should work with Internet Explorer 3.x and above.

Making an Internet Sound Button with HyperStudio. This recipe is here to whet your appetite! You can find it at http://www.mudpie.org/hyperstudio/SoundBtn.htm. This recipe shows the potential for using HyperStudio on the Internet. The program can be an authoring tool for creating multimedia files that are similar to those found on the Internet as created by Java, Shockwave, Flash, and RealMedia. Now you also can create and add sounds, animations, and video, as well as interactive games and forms, just like a professional Web designer. And you are using your own classroom authoring tool, good old HyperStudio! Just like the other recipes, this one has been tested with Netscape Navigator 3.x and should work with Internet Explorer 3.x and above. (*Tip*: If your browser opens full-size, then just click on the lower right-hand corner of the window and resize the browser to fit around your HyperStudio button. Now you have a cute little sound button that is ready for publishing on the Internet.)

To see more multimedia magic using HyperStudio on the Web, (1) download the newest HyperStudio plug-in for your browser (http://www.hyperstudio.com/lab/plugin.html), (2) install the file in the browser's "plug-ins" folder, and (3) try out the test stacks you find at http://www.hyperstudio.com/lab/tests.html; they were created by the programmers at Roger Wagner Publishing (RWP).

Additional Sites for These Recipes. You also can get online copies of these Chef Fred recipes at the "mud pie school" Web site, http://www. mudpie.org/hyperstudio/Recipes2.htm.

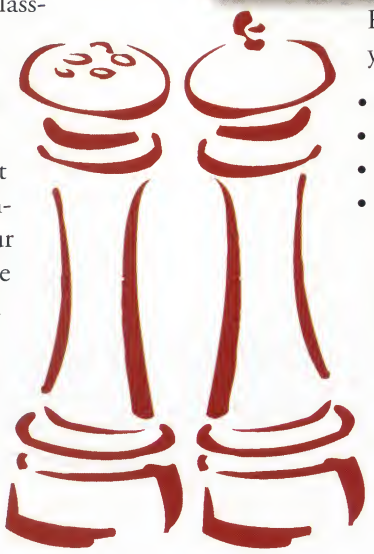
Publishing Your HyperStudio Stacks on the Internet

Your students can publish all of their Web pages onto a disk, a computer hard drive, the classroom network, and so on and create a miniature Internet or intranet without ever being connected to the real Internet. This technique lets students create in a real, authentic environment without compromising their privacy or safety—or your school's computer security.

To publish your students' stacks on the real Internet, you must upload their stacks and their HTML Web pages (see the recipe site noted above for "Opening HyperStudio Stacks Using Netscape Navigator") to the computer provided by your Internet service provider (ISP). Your students' pages will be assigned a directory on their "Web server," and you will receive a URL. Now your pages will be available to the world.

For information on how to publish your students' stacks online, go to the HyperStudio plug-ins page at http://www.hyperstudio.com/lab/plugin.html and click on two links: (1) http://www.hyperstudio.com/lab/putup.html (this provides a detailed recipe for putting your stacks online) and (2) http://www.hyperstudio.com/lab/servconf.html (information on printing or e-mailing to your ISP to make sure its Web server will "serve" up your HyperStudio stacks correctly).

Contacts for More Internet and HyperStudio Goodies



RWP is offering a new set of free booklets that you can obtain in quantity for use in workshops:

- *HyperStudio and the Internet*
- *HyperStudio: Sharing Your Stacks*
- *Storing Your HyperStudio Projects*
- *Quick Start Guide to Making a QuickTime VR Object Movie*

To obtain copies, contact RWP at the numbers and addresses listed at the end of this article.

The HyperStudio Web site itself also has many resources to help you publish and share your stacks on the Internet. Contact service@hyperstudio.com and request a

free copy of the HyperStudio preview CD-ROM; it has a lot of information about using HyperStudio on the Internet.

Get the latest 32-bit HyperStudio plug-in (from http://www.hyperstudio.com/lab/plugin.html) so that your Mac or Windows browser (Netscape Navigator 3.x or Internet Explorer 3.x) can play your HyperStudio stacks online.

You can test your new plug-in by playing stacks created by Lisa Turek's fourth graders at Bay Laurel Elementary School in the Las Virgenes United School District in Calabasas, California. You can find the stacks at http://www.lvusd.k12.ca.us/elem/baylaurel/turek/WebClass/turek/turek2.html.

Other "HyperSchool" sites such as http://www.hyperstudio.com/hyper/school.html also offer exciting stacks for you to download or "plug into" and enjoy.

Finally, http://www.hyperstudio.com/catalog/indbod.html shows dozens of resources for classroom HyperStudio projects both on and off the Web. ■

Fred D'Ignazio is the editor of the Multimedia Sandbox column for L&L. You can reach him at Multi-Media Classrooms, Inc., 1773 Walnut Street, East Lansing MI 48823; dignazio@msen.com.

Resources

HyperStudio is available from Roger Wagner Publishing at http://www.hyperstudio.com; 800/497-3778 (toll-free) or 619/442-0522; fax 619/442-0525; care@hyperstudio.com (e-mail).

Create a Web Page

Fred D'Ignazio dispels the four main myths that keep teachers from doing those fun multimedia and hypermedia projects using the World Wide Web.

By Fred D'Ignazio

There are plenty of nasty shibboleths out there that only make teacher's jobs harder. Shibboleths are defined as widely held beliefs—generally ones that are plainly obvious—and often have no real meaning outside of the group that believes them. Myths and misconceptions of this kind can sometimes frighten teachers and discourage them from doing exciting projects in technology. In this article, we are going to demolish four shibboleths, so you and your students can get started today authoring and publishing using the writer's tools of the 21st century—multimedia and the Internet. Here are the myths, followed by some common-sense tips for proving them false in your classroom.

Myth #1

You Have to Know HTML to Create a Web Page

Publishing Web pages used to be laborious and quite technical. You and your students had to learn to write Web pages using complicated tags in HTML (HyperText Markup Language). You had to create your documents with dozens or often hundreds of these tags to make the documents capable of being read by a browser program such as Netscape Navigator.

But that was then and this is now. Now publishing Web pages is easy! A new generation of Web-authoring tools have made Web-page authoring as simple as word processing. These tools include Microsoft's Front Page, Adobe's PageMill, Claris Home Page from Claris Corporation, Sunburst's Web Workshop, and WebSter from Washington Computer Systems. In addition, newer word processors let you save your text files directly to HTML so they can be read by Netscape Navigator or Microsoft Internet Explorer.

Myth #2

You Have to Be Connected to the Internet

Many teachers worry that their students will not be able to publish Internet-style Web pages until they get their school wired and they acquire an Internet account.

Happily, this is not true. In fact, you *never* have to be connected to the Internet to have a great time learning with these tools. All of the students' Web page authoring can take place on

In a Swamp!

Figures 1 and 2. Students collect data and compose elements of their Web pages on the spot using whatever portable technology is available. Later they transmit the data to their fellow researchers around the world over the Internet.

a stand-alone computer! Your students can create Web pages using a word processor or Web-authoring program. They can save the Web pages on a disk, on your classroom computer's hard drive, or on a local area or wide area network (LAN or WAN). None of these computers has to be connected to the Internet.

But don't hyperlinks (point-and-click "buttons" on a Web page) link a page to another Internet address, thus requiring an online connection? Not necessarily. Students can create hyperlinks that branch only to other locations on the same Web page. Or they can create a hyperlink to another Web page stored on the hard drive. Or they can create hyperlinks that connect to the Web pages of other classmates on other computers on a network. None of these links necessarily require an Internet connection. In fact, in most cases, all of the linked Web pages can be stored on a single student diskette!

If you have experience using a multimedia program such as HyperStudio or Digital Chisel, then you are ready! These programs use the same metaphor as the Web: "cards" or "pages" are linked to other cards and pages by clicking on buttons (hyperlinks). And, as with a program such as HyperStudio, all of the student files can be stored on a diskette or on your computer's hard drive when you're finished linking them together.

The only time you want to be connected to the Internet is for *research*. You can use your Internet connection to find good hyperlinks to copy and paste into your student Web pages. And you can use your Internet connection to link to Web sites full of rich text, images, animations, and sounds that students can copy and paste onto their Web pages.

Myth #3
You Have to Author Web Pages Indoors

What a fun myth to explode! The truth is that you and your students can author Web pages *anywhere!* In the Multimedia Detectives project we conducted in Michigan, elementary school students authored Web pages on a battery-powered laptop perched on a stump near a swamp! To learn more about our detectives and their real-world research and Web-page authoring, please visit us at two of our MUD Pie School Web sites:

- http://www.mudpie.org/LessonSum/LessonSum.htm
- http://www.mudpie.org/mitn/mmd.htm

Our multimedia detectives centered their research around real-world content experts whom they could interview in online "talk shows" by using classroom modems. Also, they took a laptop computer, video camera, and other information-gathering technologies out into Froggy Bottom Wetlands near their elementary school and searched for clues that could explain why frogs are disappearing globally from their habitats. Figures 1 and 2 show the students out in the wetlands gathering data.

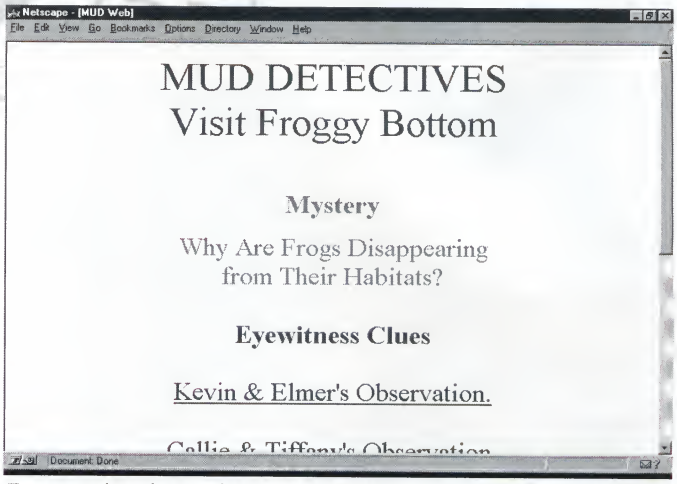
Myth #4
Web Pages Have to Be Fancy

Phooey! Not true! You and your students can create any kind of Web pages you want to—the same as word processed pages. You can make your Web pages incredibly fancy, or you can keep them short, quick, and simple.

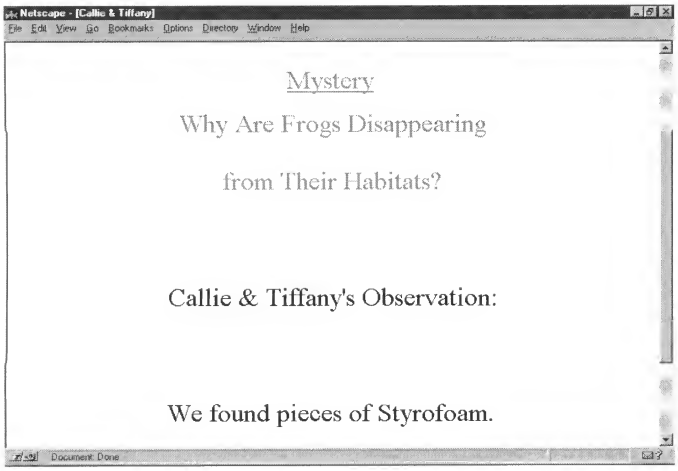
We've included three Web pages created by our multimedia detectives while searching for clues in the swamp (figures 3, 4, and 5). They authored the pages on a Macintosh PowerBook that was resting on a tree stump. These Web pages are anything but fancy, yet they are still bona fide Web pages, created in Claris Home Page. The neat thing is that we were able to take our laptop computer back to school, plug it into a modem, log on to the Internet, attach these pages to e-mail messages, and send them to other schools around the world the very same day.

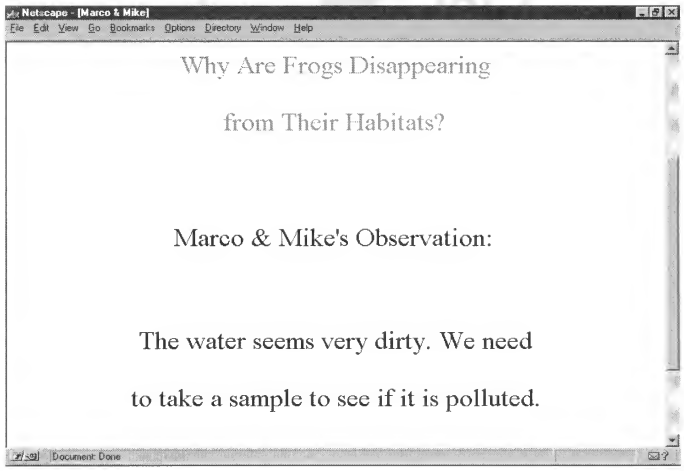
You can also access these Web pages at our online MUD Pie School Web site at:

- http://www.mudpie.org/froggy/froggy1.htm
- http://www.mudpie.org/froggy/DETJRNL/MudWeb2.htm



Figures 3, 4, and 5. Students can create Web sites that are very simple, such as these sample Web pages where students have written some of their research findings after working on the Froggy Bottom research project. Students from all over the world are participating in the project, which aims to explore the reasons behind the global disappearance of frogs from their wetland habitats.





Web pages can be elegant and filled with animations, sound files, and graphics. Or they can be on-the-fly note cards (similar to 3" x 5" cards) that students quickly create based on their ideas or eyewitness observations. The types of Web pages you create should depend on the task you assign. They can be as varied or diverse as any other document that you and your students publish.

Total Publishing Flexibility

If you use a newer word processor or an Internet authoring program, you and your students have total flexibility for publishing all sorts of things. You can keep it simple and publish only on paper. Or you can get fancy and publish globally on the World Wide Web. It all depends on what kinds of resources you have and what kind of audience you want to see your work.

You can use the Web-authoring program or your Web browser to print out color copies of your students' pages so they can take them home to share with their parents. And you can have your students save their Web documents on their own personal disks that they can take home.

Taking Web pages home on a disk is an especially exciting possibility. If the HTML files are created on the PC platform and a student's family computer is a PC or Macintosh, the home computer will recognize the student's Web pages using any of the free browsers now available for each platform. Your students can open the pages with either Netscape Navigator or Microsoft Internet Explorer to show their families what they've done at school. Hyperlinks on the students' pages can be activated when they go online at home, and they can show how clicking on their disk-based Web page can launch the whole family out onto the World Wide Web to browse through educational sites the students have researched and linked to in school. ■

Fred D'gnazio is the editor of the Multimedia Sandbox column. Fred can be reached at Multi-Media Classrooms, Inc., 1773 Walnut Street, East Lansing, MI 48823; dignazio@msen.com.

Think Intranet

Help students develop publishing abilities and collaboration skills in a networked environment without having the security risks associated with Internet connections. Create an internal network where students can participate in collaborative projects and safely showcase their work. Most schools and districts can do this with the equipment they use now.

By Fred D'Ignazio

The intranet can be a magnet for collaboration: Students can create joint projects on a school district intranet that bridges grade levels, buildings, and curriculum disciplines.

The hottest buzzword in technology is no longer "Internet." It is "in-TRA-net." An "intranet" is a small, private network that is created exclusively by a company or institution. All the documents in an intranet are formatted in standard hypertext markup language (HTML) so that they can be read by every computer on the organization's computer network. These machines can still access the bigger Internet, but no one from outside the organization can get in to the intranet. According to *Business Week* (February 26, 1996), the growth of organizational intranets will far surpass the growth of the Internet over the next five years.

Why not create an intranet for your school district, your school, or even your classroom!

Your private intranet will be a protected region where students can publish their pictures, biographical information, and so forth without fear that this information will fall into the hands of strangers. Also, teachers can successfully control the content of materials on the intranet to make sure it is in good taste and fits the values of the school system and community.

Most importantly, the intranet can be a magnet for collaboration: Students can create joint projects on a school district intranet that bridges grade levels, buildings, and curriculum disciplines. Teachers can collaborate on common thematic projects and use lessons developed by colleagues on the intranet to help them coteach important curriculum areas. The intranet can be seen as a prototype "school of tomorrow" that you and your students can create today, right inside your own classroom! It offers the opportunity for unlimited student, teacher, and community collaboration without the dangers associated with the larger Internet.

Authoring for the Intranet With Your Word Processor

Your students can begin authoring for an intranet immediately. The only requirement is that they publish their work in HTML format if they want their audience to be able to view it graphically.

In the May 1996 Multimedia Sandbox article, I provided some "quickstart" recipes to show you how you can create documents in the ClarisWorks word processor and save them in HTML. These documents can become part of an intranet simply by being copied on an intranet server, which can be accessed by other computers on the intranet. If your intranet covers your school district, you need to transfer these files (with the system administrator's help) to the district server. If you have a school-wide network, you need to transfer them to your building server. And if your intranet is just in your classroom, they must be on the local area network (LAN) server for your room. Or, if you only have standalone computers (or computer!), just load the documents into a folder or directory on your computer's hard drive. Yes! Your hard drive can be the server for your classroom intranet!

WebSter

There are many authoring tools that help you author for the Internet. These same tools (including Adobe's PageMill, Quarterdeck's WebAuthor, Claris' Home Page, and InContext's Spider) can be used to author on the intranet. However, many of these products are rich and complex tools, and they may have more features than you need when you first begin. Instead, it might be best to use your friendly old word processor and save your documents using "Save As..." to create an HTML

file—a feature found in the latest versions of many major word processors.

As an alternative—if you are a PC user—you might consider a neat little program called WebSter, published by Washington Computer Systems.

In Figures 1 and 2 you can see the same page created by Cindy Lafkas, a fifth-grade teacher, using WebSter. Figure 1 shows what the page looks like in WebSter. Figure 2 shows how the page would look in Netscape Navigator, the most popular browser program for both Macs and PCs. Note that the two pages look very similar: WebSter to Netscape is a pretty direct conversion.

Every time you save a file in WebSter, *two* files are created: a WebSter file that you can go back and edit and an HTML file that Netscape (or any other browser, for that matter!) can read. Figure 3 shows the HTML code created automatically in WebSter.

WebSter doesn't come with any bells and whistles. Using Webster, all you can create for the intranet are text, graphics, and hotlinks to other pages. But this is enough to get started. And your students' intranet pages can contain numerous hotlinks that will launch the user beyond your classroom intranet, out onto the big Internet with its vast ocean of resources! (Remember, on an intranet, you can go outside any time, but only authorized users can come in.) ■

Software

WebSter. Washington Computer Systems, 2601 North Shore Road, Bellingham, WA 98226; 206/734-8248. A preview copy is available by downloading it from http://www.nas.com/~larryk/.

Fred D'Ignazio is the editor of the Multimedia Sandbox column. Fred can be reached at Multi-Media Classrooms, Inc., 1773 Walnut Heights Drive, East Lansing, MI 48823-2945; dignazio@msen.com; WWW: http://www.tcimet.net/mmclass/.

```
<html>
<head><title>        Ms. Lafkas' 5th Grade Class</
title></head><body>
<a name="PGID1"> </a>
<p>
<h1>        Ms. Lafkas' 5th Grade Class
</h1>
<p>
<CENTER>
<IMG SRC="pencils.gif"></CENTER>
<p>
<h1>Cornell Elementary School
<p>
</h1>
<p>
<h1>Okemos, Michigan
</h1>
<p>
<IMG SRC="cindybtn.gif"><p>
<a href="#PGID2">To learn about Ms. Lafkas,
click here.</a><p>

<p>
<hr>
</body></html>
```

Figure 3. HTML code for the Web page as created by WebSter software.

The intranet can be seen as a prototype "school of tomorrow" that you and your students can create today, right inside your own classroom!

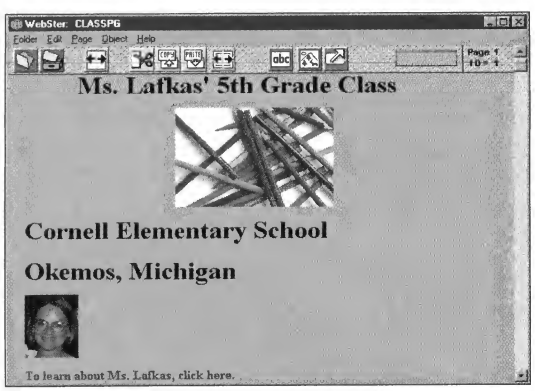


Figure 1. A teacher's Web page as read by WebSter.

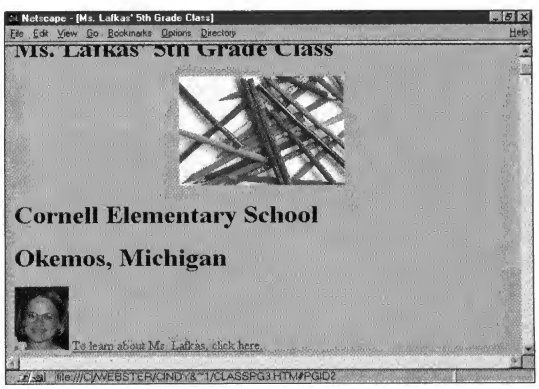


Figure 2. The same Web page as read by Netscape Navigator.

District Administration
K-12 Education Leadership, Curriculum, Technology & Trends

December 13, 2001

Congratulations! I want to take this opportunity to congratulate you again for being chosen as one of the top Education Technology Advocates by District Administration. Please enjoy your framed certificate and a complimentary issue of our December issue, which includes short stories about all of this year's winners.

If you would like any additional copies of the magazine, please contact me at wdorio@edmediagroup.com.

Sincerely,

Wayne D'Orio

Wayne D'Orio
Editorial Director

488 Main Avenue, Norwalk, CT 06851 203-847-7200 Fax: 203-846-1866

Fred D'Ignazio

ONE *of* THE TOP 25

EDUCATION TECHNOLOGY ADVOCATES

December 2001

For innovation and dedication to improve not only what, but also how, students learn

District Administration

THE TOP 25 Education Technology Advocates

cover STORY

The common, and not untrue, criticism often heard about K-12 education is that it doesn't embrace change. Let's face it, adults outside of education could walk into most classrooms today and recognize many similarities to when they attended school.

But blanket statements, even if true for the majority of school districts, administrators and teachers, don't cover the innovators.

When Editor Laura Dianis came up with the idea of creating this section, it was with the thought that not only would we recognize the visionaries, but we would offer a blueprint to others who may want to make changes, but for a variety of reasons, haven't yet.

When we compiled the list, we were surprised to see the diversity of people and jobs included. Because some entries contain two people, our list actually numbers 29. We have 13 educators on the list, from teachers to superintendents to higher education professors. But we also have two governors (in Tom Ridge's case, a former governor), six people chosen for their work in associations, four people who are gurus for education technology ideas, and four people who affected change while working in government jobs.

While all of these profiles prove that change can occur when strong people act upon innovative ideas, this list also proves that change can come from many different places, in many different forms.

We hope you enjoy learning about our choices and what they have accomplished. But most of all, we hope this information spurs you to consider improvements in your own school district.

Yvonne Marie Andres

Yvonne Marie Andres & Al Rogers

They are committed to **linking teachers and kids** through Internet-based learning

In 1984, Yvonne Marie Andres, a Title I teacher in Oceanside, Calif., met Al Rogers, who was running a meeting at the San Diego County Office of Education. When Rogers announced the formation of a new technology called electronic mail, Andres immediately felt a connection.

The pair set up the Free Educational Mail Network for every teacher in every school in the U.S., promoting its use for student writing projects. "We were really convinced that this truly would make a difference in how kids learn," Andres says.

Al Rogers

And the rest is history? Not in the world of technology. Their venture became the Global SchoolNet Foundation in 1990, and in 1993 GSN created an educational Web site called Global Schoolhouse. Andres, 49, serves as president and CEO, and Rogers, 59, is COO and CIO. "I tell him what we need and he figures out a way to make it happen," Andres says of their partnership.

Through the International Schools CyberFair program, which is now in its seventh year, the site asks students to conduct research about their local communities and share their findings on the Web. The site also "connects kids to real people doing extraordinary things" through its online expeditions, Andres says. All of GSN's projects encourage collaborative learning, or creating a learning community around a topic and a common goal.

Andres remembers how she felt in 1984 as she and Rogers promoted the idea of e-mail in education. "We spent years trying to raise awareness, jumping up and down saying, 'Look at this!' We feel the same now about collaborative learning that the Internet allows." —*Melissa Ezarik*

James Apana & Tom Saka

This Maui politician and educator pioneered a way to **bring technology to its remote population**

You think your school's computer specialist has problems? Imagine if he or she could only move about your district by airplane. That was one of the major challenges faced by the Maui County School District in Hawaii, as it attempted to network its schools across the district's three islands.

"You can't have a systems administrator taking a plane and renting a car every time a school's computer system needs trouble-shooting," says Tom Saka, 41, information specialist for the Hawaii Department of Education.

Solving Maui County's unique logistical problems was just one aspect of a comprehensive, ongoing effort to enhance computer literacy skills among the county's students. The county's dynamic mayor, James Apana, 39, has been at the forefront of this effort. Concerned about the reluctance of technology firms to locate in Maui, he went to Silicon Valley to persuade companies there to do research and development in Hawaii. During his visit at Sun Microsystems, he became enamored of the Sun Ray, a thin-client device that allows users to access software and the Internet from any station within the network. Apana decided to make this technology the basis for the school district's plan to place computers in every public school classroom, youth center and library in the county of Maui.

James Apana

Initially, the school district had no pot of money for such a major initiative. But that didn't deter Mayor Apana, or Saka, who, as the man in charge of "non-traditional computing," had been building and coordinating the school district's messaging, information management and collaboration infrastructure during the last six years. Mayor Apana decided the county should pay the $1 million required to implement the technology and then hold fundraisers to recoup the expense.

Tom Saka

As a result, 1,400 Sun Rays and 55 Sun servers were installed on three islands. The allocation was one appliance per classroom, plus an extra five for school administrators, support staff, counselors and the school office. —*Laura Dianis*

Andy Carvin

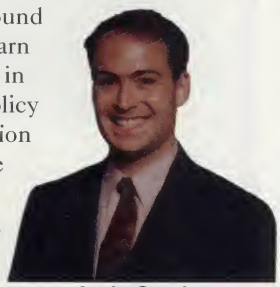
He **introduced educators and technology experts** via the Web

Andy Carvin, 30, a Northwestern University graduate with a master's in telecommunications policy, essentially started his career as a

New Media Program Officer for the Corporation for Public Broadcasting where he developed Internet-related grant programs for the public broadcasting community.

"I never thought I'd have a career in this," he says now. "In many ways I was in the right place at the right time."

So Carvin, now a senior associate at the Benton Foundation, which works in part to demonstrate the value of communications for solving social ills, created EdWeb: Exploring Technology and School Reform, or Edwebproject.org. Among the first Web sites to advocate using the Web in education, it's designed to explore educational reform and information technology. On the site, anyone can track online educational resources around the globe, learn about trends in education policy and information infrastructure development, as well as keep up on Carvin's adventures around the globe—just for fun.



Andy Carvin

Carvin is also a coordinator of the Digital Divide Network, a national coalition of IT corporations and nonprofit foundations working to find solutions to the digital divide. Last March, he developed ConnectNet.org, a national database of more than 20,000 sites that offer free Internet access and IT training.

Carvin says his role is merely to "focus the debate" and help people from different cultures and philosophies understand the different roles in the process, such as a school's role in the digital divide or a teacher's role to use technology effectively.

"I think one thing that has been proven in the last couple of years is that putting the Internet in the classroom isn't going to change anything unless teachers are prepared with the skills to teach effectively and be culturally acclimated" to the potential of the Internet in the classroom, he says. —*Angela Pascopella*

Fred D'Ignazio

He **envisioned multimedia computers before they existed** and has promoted their use in education ever since

Fred D'Ignazio

"I've always thought of myself as Johnny Appleseed—going around with my seeds where things can grow and planting them," says Fred D'Ignazio, 52. An internationally renowned author, consultant, educator and television commentator and president of Multi-Media Classrooms Inc. (which offers multimedia training workshops to schools), D'Ignazio remains humble.

As a classroom helper dad, D'Ignazio fills in where needed and is careful not to tell teachers what they ought to do. "The better thing is to be totally service-oriented," he says, adding that just being in the classroom helps him with his own work. "It has tamed my imaginative ideas and made them more practical."

But his workshops are by no means typical. "Paper Training Sparky the Dog: A 12-Step Program" is a staged intervention. Teachers must come to admit that adults are paper trained and paper centered, while kids are real-time, electronic centered. As D'Ignazio offers technology integration tips, he has been known to fall down, stand up on chairs, run out the door, even don a jungle or hip-hop costume … anything to entertain. "I probably should have been a clown," he says.

One of D'Ignazio's greatest feats, however, is his 1979 picturebook, *Katie and the Computer* (starring a character like his own daughter, Catie). In the story, Katie sees a colorful flower on a computer screen and tumbles through it into a world of adventure. Essentially, the book predicts the future multimedia capacities of computers.

As D'Ignazio's career took a turn from computer programming to educating, it was his children—first Catie and his son Eric, and now Laura—who inspired him and became his sidekicks during presentations. At home, they have the chance to learn multimedia tools from an expert. And D'Ignazio has the chance to watch as imagination meets technology. He says, "One of the luckiest things about being a parent is you get to have a box seat." —*ME*

Mark Edwards

He **transformed his district's technology program** by giving a laptop to each student

When it was time to upgrade hardware for his Henrico, Va., district, Mark Edwards, superintendent, wanted to make more than the predictable improvements. He wanted to take several leaps into the future.

He accomplished that in July when he announced his plan to give an Apple iBook laptop computer to every student and teacher in the district. "Our challenge was to bridge the digital divide," says the 49-year-old superintendent, who has served in Henrico for eight years. In his district—which spans rural and urban areas—about one-third of the students had no access to technology at home. Edwards and his staff remedied

that this year, with a program that allows students to use the laptops in school and at home. A complementary wireless network, which takes advantage of the iBook's airport card technology, gives students access to Internet lessons from anywhere on the grounds: the cafeteria, the auditorium or the school steps.


Mark Edwards

A total of 23,000 iBooks will be given to students and teachers by the end of this year. Edwards and his staff pulled this off by signing a four-year, $18.6 million lease agreement with Apple. Each new iBook was acquired for a discounted price of $900. With iBooks in hand, Edwards hopes to realize cost savings while improving resources. Eventually more online lessons will replace textbooks, and the space allocated for computer labs can be used for other needs. —*Jean Marie Angelo*

Nina Hansen

She created a Web-based community that has **reached students on every continent**

Nina Hansen, 55, was one of the first to blaze new trails in using the Internet for K-12 teaching and learning projects, and she inspired countless teachers throughout the world to follow suit. Her groundbreaking "Save the Beaches" project started in 1991 as a text-based e-mail science and social studies program involving six schools, and it grew to become an annual Web-centered project involving teachers and students on every continent.


Nina Hansen

The concept was for participating classes around the globe to collect, categorize and analyze trash from local beaches, contribute results to project databases, and compare their findings with schools in other regions. The students also devised plans to rid local beaches of selected kinds of litter such as plastic straws, which typically involved publicity and letter-writing campaigns with follow-up evaluations.

Save the Beaches has received international recognition through books, articles, workshops and awards—including DA's Curriculum Web Site Award in 1999. It has been offered in languages including Danish, German, Portuguese and Spanish, and is presently headquartered in Brazil at pekids.nlink.com.br. Hansen made online projects accessible to teachers, and continues her leadership as an adjunct faculty member at the University of Hartford, vice president of the Connecticut Educators Computer Association, and Educational Director for Australia-based SchoolWorld, www.schoolworld.asn.au. —*Odvard Egil Dyrli*

Dennis Harper

He developed a model that **empowers students as primary reformers** of education

Dennis Harper, 55, grew up in several schools around the world as a so-called military brat. "I always wanted to teach," he says. "I just thought that I could contribute to make schools better."

He taught in an East Los Angeles High School, earned a doctorate degree in International Education from the University of California in 1983 and traveled the world to bring the first computers into classrooms in 34 nations.

In 1992, Harper returned to the U.S. and created the Generation Y program through a U.S. Department of Education Technology Innovation Challenge Grant. The program essentially trains students to train teachers in technology. Teachers in participating schools are paired with students who actually create projects using technology, ranging from e-mailing students abroad to creating


Dennis Harper

historical hometown videos. The projects are then used as teachers' curriculum tools for future students.

Harper says he is most proud that he helped open people's eyes that students must be involved in their education. It's about "getting people to realize that kids with expertise in technology … can become partners in school reform and can become change agents," he says.

After the Challenge Grant was eliminated this year, Generation Y has become Generation YES (Youth and Educators Succeeding) which is the same program but funded by individual schools and other grants. Having been implemented in 41 states, the program was designated "exemplary" last year by the U.S. Department of Education's Educational Technology Expert Panel. —*AP*

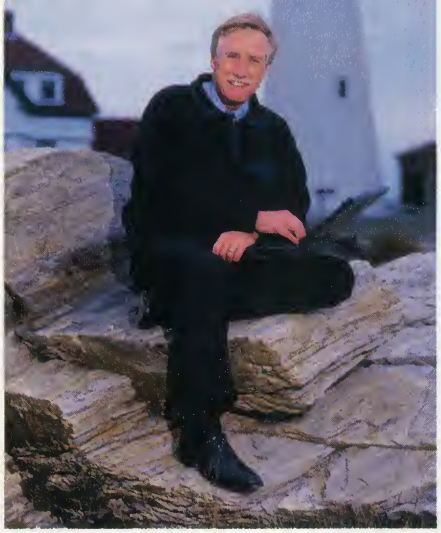
Judi Harris

This professor from the University of Texas at Austin, has **made telecommunications technology real** for educators

Judi Harris, 42, has possibly done more to equip the K-12 education community with curriculum-based telecommunications information, skills and models than almost any other educator in the world. She has authored major texts on classroom applications of online technologies, including *Way of the Ferret: Finding and Using Education Resources on the Internet* (ISTE, 1995), *Teaching and Learning with the Internet* (ASCD, 1996), *Design Tools for the Internet Supported Classroom* (ASCD, 1998), and more than 150 professional articles.

She has initiated numerous Internet projects such as Wings Online, emissary.ots.utexas.edu/wings, for telementoring teaching interns and novices, and the popular "Electronic Emissary Project," emissary.ots.utexas.edu/emissary, that matches volunteer content area experts with *K-12 classes for mentoring* learning projects. Harris also does continuing research in education telecommunications and professional development. —*OED*

Judi Harris



Angus King

Angus King

He used a budget surplus to buy **laptops for all of Maine's seventh and eighth graders**

Independent politicians are mavericks. As one of only two independent governors in the U.S., Angus King of Maine, 57, doesn't play it safe.

In 2000, when the state realized a $30 million budget surplus, King was urged to spend the money on school building renovations and teachers' raises. Instead, he proposed buying every seventh and eighth grade student a laptop computer. His rationale is easy to follow. Maine needs to train its future workforce to be technologically competitive. He noted that about 70 percent of Maine's workforce use computers every day, yet only 2 percent of its students had daily access to computers. Computer labs just weren't cutting it for King. "Michael Jordan would never have been as good as he is if he only played basketball 43 minutes a week," says King.

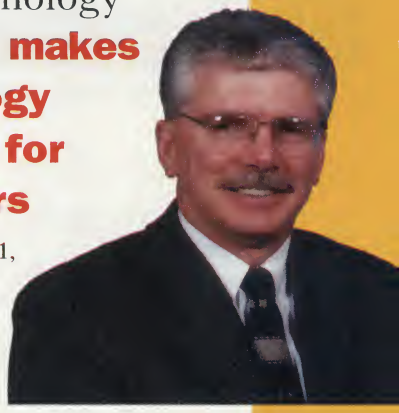
One voter bluntly asked why Maine—a poor state—had to be a leader in education. "Can't somebody else lead?" King was asked. His answer: "We'll stay poor unless we lead."

"I took a lot of flack," King admits. He eventually won. His plan was passed by the Maine legislature this May.

His next effort will be setting up a wireless Internet network through the school system, so that students can have access at school and at home. —*JMA*

John Kuglin

This technology evangelist **makes technology tangible for educators**



John Kuglin

John Kuglin, 51, is passionate about using technology to its fullest potential. When speaking to educators at conferences around the world, Kuglin gets audiences excited about technology by helping them put the "technology puzzle" together. This dynamic presenter has 25 years of experience as a classroom teacher, district technology director, senior director of technology for the U.S. Department of Education and as a former director of educational outreach at the University of Montana-Missoula.

While he has spoken to an estimated audience of 150,000 educators, Kuglin attempts to reach each member of his audience. "All educators need to have their personal piece of digital real estate developed," Kuglin says. Just recently, Kuglin received an e-mail "out of the clear blue sky" from an educator in Omaha who had seen his presentation and was influenced to dive deeper into the world of technology.

A few months ago, Kuglin joined ComChoice Inc. as vice president of education and training programs. In his new position, Kuglin hopes to get educators "excited about the possibilities DVD and it's large bandwith can bring to the education arena." —*LD*

Darryl LaGace & Barbara Allen

Darryl LaGace & Barbara Allen

They helped create a high-speed network to **connect students' homes to the school**

Many of the reasons that educators give for a lack of innovative programs are present in the Lemon Grove (Calif.) school district.

A preponderance of low-income students? Lemon Grove has that. A majority of children with limited English proficiency? Yes, the K-8 district near San Diego has that. Yet this district's goals were straight forward, but far-reaching. Administrators wanted to bring students not only up-to-level in English and learning but also to have them use technology as an everyday tool.

So how did this district overcome its obstacles to become Bill Gates' favorite example of a "connected learning community?"

Enter Darryl LaGace, the director of information services, and Barbara Allen, LemonLINK's project director. Through the hard work and leadership of these two, the district now boasts a high-speed WAN that connects not just the district schools and offices, but also its students' homes, City Hall, Public Works, fire stations and senior centers.

LaGace designed the network and keeps it running. Allen runs LemonLINK's teacher-training component, a pivotal part of the project that makes sure that all teachers are up-to-speed on all the technology the district has to use. —*Wayne D'Orio*

Marc Liebman

A former businessman, this superintendent has **made technology the nucleus** of his district

The education industry does a lousy job when it comes to customer service. At least that's what Marc Liebman, superintendent of the Marysville Joint Unified School District in Yuba County, Calif., believes. Prior to his current position, Liebman, 52, served as IBM's principal consultant for education management. It was there that he learned how big business is in demand to constantly upgrade its products and services to meet customer needs; yet he doesn't find the same drive to keep improving education.

"Working at IBM gave me a frank look at how business works and how often schools ignore customer service and satisfaction to the detriment of the very students that we are challenged to educate," Liebman says.

Marc Liebman

And when it comes to "technology for technology's sake," Liebman doesn't buy it. One of his proudest accomplishments has been "using technology effectively to target student needs." Liebman says, "We can document that each new technology we have brought in has shown measurable data in increased test scores."

Using his business experience, Liebman has found ways of infusing money into his district—mainly through aggressive grant seeking.

For example, the district secured a $700,000 competitive grant through the California Digital High School Program that has helped fuel a number of tech initiatives.

Other examples of how the district is spending money include:

- High speed communication between and within schools allowing voice, data and video capabilities in all classrooms.
- A laptop pilot program for teachers.
- Partnership building. "We are creating major partnerships to "take advantage of favorable pricing for both hardware and software purchases." —*LD*

Ted Maddock

He **created an award-winning multimedia lab** at his high school

Five years ago, Ted Maddock was a veteran teacher at a California high school trying his best to save a class of students who weren't advancing to college, or weren't even good bets to graduate.

Today, the 54-year-old teacher is the director of The Digital Safari Multimedia Academy, a school-within-a-school at Mt. Diablo High in Concord, Calif.

How he went from one spot to the other is the best type of education example, a mix of opportunity, vision and plain hard work.

When Maddock's district received a government grant for a project no longer under consideration, he used a year off from teaching duties to reinvent his district's vocational program. The two-year career academy "teaches core academics in a technology-rich,

Ted Maddox

collaborative environment," the former woodshop teacher says.

Students, from special ed to National Merit scholars, learn how to create Web pages, install the latest technology and hone skills that can earn them well-paying jobs right out of high school.

His program has exceeded its grasp. Besides a waiting list that includes some of the best students in the district, Maddock finds that his students are getting better grades in other classes and their attendance rates have improved. Best of all, he can't keep the children out of the lab.

Students come in before school, during lunch and stay afterschool so much that Maddock had to make rules about when the lab is open. Even children not eligible for the junior and senior program are found lurking at the lab's multimedia

David Moursund

machines, hoping to glean some information that will make their entry into the program easier in the years to come. —*WD*

David Moursund

He founded ISTE, and in doing so **ensured technology's place in education**

David Moursund, 65, recently retired after working for four decades as an academic and advocate for technology in education. As founder of ISTE, the International Society for Technology in Education, Moursund helped the organization grow into an international interest with 70,000 affiliated members and 50 chapters. He was also editor-in-chief and founder of ISTE's *Learning & Leading with Technology*.

Prior to forming ISTE in 1989, Moursund led the International Council for Computers in Education. Most recently, he has been instrumental in establishing technology standards for teachers and students. Now ISTE has released standards for district administrators, too.

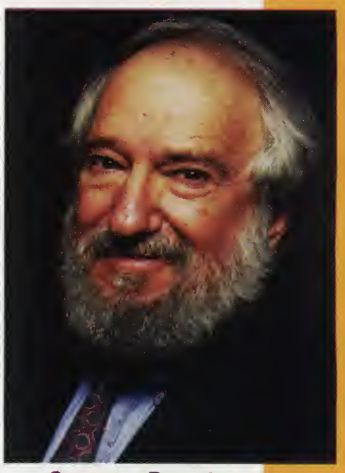
"I am proud for starting an organization that has grown to its current breadth, depth and scope," he says.

Moursund balanced his work for ISTE with his academic achievements at the University of Oregon. As a professor of education, he taught, researched and wrote about technology. He began teaching about technology as early as 1963, when he ran a summer program for talented and gifted students. In 1965, he started training teachers. This, he says, was not only informative, but fun.

Not one to be complacent, Moursund still sees much work ahead. It isn't enough to have computers in classrooms, he says. Educators can take technology to the next level by incorporating computers and the Internet into state and national testing and by pushing Internet use beyond e-mail messaging and simple Web searches. He plans to continue volunteer work with ISTE to help this vision become reality. —*JMA*

Seymour Papert

The father of **educational computing**



Seymour Papert

Here's a list of education milestones: The 1971 book, *Twenty Things to Do with a Computer*; creating the Logo computer language; becoming the driving force behind the LEGO Mindstorms programmable brick.

Any one of the previous accomplishments might qualify a candidate to make this list, but in the case of Seymour Papert, 73, all these accomplishments—and more—are his.

Papert is now the LEGO professor of learning research at the MIT Media Lab, but his contributions to education stem back nearly 40 years.

In the 1960s, he predicted not only that every child would have a personal computer, but that they would also program the computer. He backed up this vision by creating the Logo language, a computer programming code that provides a way for students to learn formal connections between disciplines. Millions of children have learned with his Logo, and its current versions, such as MicroWorlds.

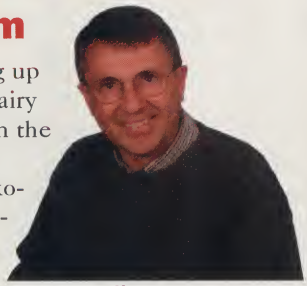
In 1987, he was the main inspiration behind LEGO's TC logo, a product that allowed children to construct complex machines and control them with simple Logo programs. From this grew the era of child programmed toys, including the recent LEGO Mindstorms

programmable block.

Papert's genius is three-fold—his ability to dream big dreams, his willingness to risk criticism by recommending strategies to realize his vision and his uncanny predictions of how the current school system will co-opt the ideas. —*WD*

Jim Parry

He has led South Dakota in **educational technology use and school reform**



Jim Parry

Growing up on a dairy farm in the plains of South Dakota, Jim Parry's first career aspirations involved what he didn't want to do. "For darn sure I knew farming wasn't going to be my career," he says. "It's much too hard."

However, taking his father's strong work ethic and an appreciation for the world of education from his mother, a teacher, Parry chose no easy occupation. As a special education teacher in the late 1970s, Parry discovered technology's potential for his students, and his interests took a swing in that direction.

After earning a Ph.D. in educational technology and special education from Utah State University, Parry returned to his home state in 1986 to direct an initiative called Technology & Innovations in Education, a statewide, non-profit organization. Of TIE's many projects, Parry, now 51, is most proud of its annual education conference, which attracts one-third of the state's educators.

"Sometimes educators in rural states are underestimated," Parry says. "No, we don't have some of the resources and access to some of the opportunities that urban areas can offer, but I've also discovered that rural areas are rich and deep in their commitment to education." —*ME*

Amy Perry-DelCorvo

This technology leader **brings professional development to teachers** and courses to students at home

Amy Perry-DelCorvo, 34, wanted to be an accountant while growing up in Buffalo, N.Y., but she found it "impersonal."

"I needed a field where it was important to be a good person and teaching is where I found that success," she says.

So Perry-DelCorvo became a kindergarten teacher at Arkport Central School in New York, where she later became computer coordinator.

Wanting to have a greater impact in a regional area in 1996, she went to Wayne Finger Lakes BOCES, or the Board of Cooperative Education Services. She is president of New York State Association for Computers & Technologies in Education and a Board of Directors member of International Society of Technology Educators.

As Education Strategist at BOCES, Perry-DelCorvo transformed education, in part by gaining technology grants and creating a Web site, AccelerateU.org. "We were one of the first to go online for professional development for teachers" and teach classes online for students, says Perry-DelCorvo, winner of ISTE's 2001 Outstanding Technology Leader Award.

Amy Perry-DelCorvo

During the past five years, 110 school buildings in 47 school districts were wired and received equipment and training to link students, teachers and parents to the Internet.

Under AccelerateU.org, teachers can take professional development courses and high school students could take curriculum courses if they can't make it to school for such reasons as emotional or disciplinary problems, she says.

But Perry-DelCorvo, who also works with Cisco and Xerox, is modest. "While I do believe I have vision and drive, I am not the one that makes technology integration work," she says. "We have very strong collegial support at BOCES, NYSCATE and ISTE … I simply share the successes of our region … with others so the success can be replicated." —*AP*

Patrick Plant

Patrick Plant & Kate Clark

SIF pioneers help refine the interoperability framework

In 1998, Microsoft came up with a simple, but potentially groundbreaking, idea. What if all the software programs a school needed could "talk" to each other and share relevant information?

Kate Clark

The Schools Interoperability Framework grew out of this idea. And while this concept and getting more than 100 competing companies to sign up is impressive, the hardest work was yet to come.

The initiative, now run by the Washington, D.C.-based Software and Information Industry Association, needed some school districts to test the new system.

This is where Patrick Plant, 46, and Kate Clark, 48, come in. Plant, the technology coordinator at the Anoka-Hennepin School District in Coon Rapids, Minn., ran the first test of SIF in 1999, and later served as the group's acting director until Director Tim Magner came aboard.

Plant was one of the first to see the many benefits of SIF. Not only does the system save multiple entries by school personnel, it allows schools to have a wealth of student information available for analysis immediately. It also allows districts to pick the best software products, as long as they are SIF compliant, without any worry that these products won't work together.

Kate Clark, principal of the Ocoee Middle School in Orange County, Fla., *not only* pushed to make her school a SIF site, but she badgered the vendors to make their software bend to her school's needs. Her attitude then, and now, is, "If I can think of it, [they] should be able to make it happen. Quickly."

These two educators are key reasons why the SIF initiative continues to move toward unified standards and possible mainstream adaptation. —*WD*

Tom Ridge

As governor of Pennsylvania, he **made education a cornerstone** of his administration

Tom Ridge has a serious new assignment as the director of the new Office of International Homeland Security. He is charged with keeping America safe. His is a new cabinet post, created as a result of the events of Sept. 11. But before he was tapped for a national role, Ridge, 56, ran the state of Pennsylvania. There he lived up to his promise to advance educational efforts and to oversee technological improvements.

Under his leadership, Pennsylvania spent more than $240 million on creating a high tech infrastructure for schools. The network, called Link-to-Learn, has been enhanced by the state's various technology partnerships, including a recent deal signed with AOL@School. Earlier this year, Pennsylvania made AOL's free educational software program available to all K-12 schools. The program includes information on state standards, staff development, Pennsylvania education news and teacher-certification facts.

Tom Ridge

Pennsylvania had already signed partnership agreements with MCI Worldcom and Oracle.

It was under Ridge's leadership that Pennsylvania instituted performance level criteria for schools, giving teachers, students and parents a better understanding of technology in the classroom. —*JMA*

Linda Roberts

She was the Federal Department of Education's longtime **point person for education technology**

Linda Roberts

Linda Roberts is widely recognized for her efforts to improve the awareness and incorporation of technology in education. As the senior adviser on technology to the secretary of the Department of Education, Roberts headed up the Office of Educational Technology from its inception in September 1993 to January 2001. She was responsible for coordinating the department's technology programs, growing the technology budget to more than $900 million annually. During her tenure Roberts directed three landmark studies on the use of technology in education for the Congressional Office of Technology Assessment.

She also spearheaded the four main goals of the department's Technology Literacy Challenge: to put powerful computers into the hands of teachers and students in the classroom, connect those classrooms to the Internet, work to train all teachers to use technology tools and resources across the curriculum, and encourage the development of applications that would yield both compelling and effective content for learning.

Speaking about her tenure Roberts says, "I've had the great opportunity to meet educators

around the country who are using technology in innovative ways. This experience has reinforced that teachers are key to the effective use of technology in education." Crediting the technology education community at large, Roberts says, "Together we have made tremendous progress on the four national technology goals and in focusing the nation's attention on the power of technology to support teaching and improve learning." —*LD*

Allen Schmieder

He grew up to **spearhead national technology programs** that promote technology in schools

Allen Schmieder

There's not enough space here to accurately write about Allen Schmieder. Now the vice president for K-20 Education and Technology Futures at JDL Technologies, which has served the nation's schools for 10 years, Schmieder, 68, was a key player in developing the Technology Innovation Challenge Grants, which were recently eliminated but funded technology-driven programs, including Generation Y and Virtual High School programs.

Among many accomplishments, "I'm proud of what I'm doing now," he says. "I'm criss-crossing the country arguing that the real Digital Divide is between schools and the rest of society … I'm writing a book on the major barriers of the effective infusion of technology in schools … and educational leaders don't realize how huge that gap is. I'm trying to change that."

Schmieder grew up in a poor family of nine in Pennsylvania. But with a positive attitude and brains, he became a professor at Ohio State and University of Maryland, where he established faculty and student academic recognition programs.

He then went to the U.S. Department of Education where he served seven presidents, and most recently worked with former Vice President Gore to set up a worldwide technology-rich research and education program in 8,000 schools in 80 nations.

He helped start or started national initiative programs, including National Teacher Centers program and created the Eisenhower Mathematics and Science Program.

A well-known author, Schmieder also helped develop the Minnesota eSchools Program to transform schools into technology-based 21st century learning centers. —*AP*

Elliot Soloway

He says asking teachers to "integrate technology" is the **biggest educational change in 200 years**. But he tells them it is achievable

Elliot Soloway

Elliot Soloway, 55, is among the most active and experienced education technology researchers and developers in the world, and is an expert in modeling and visualization tools, project-based software, intelligent tutoring systems and staff development. He has written hundreds of books and magazine articles, done countless conference presentations, consulted with numerous technology companies, directed millions of dollars of funded projects and worked intensely with school systems throughout the U.S.

Soloway is committed to helping students and teachers "engage in serious intellectual inquiry around authentic, meaningful, motivating, mindful-learning experiences."

For the past 10 years, Soloway and his colleagues at the Center for Highly Interactive Computing in Education, hi-ce.eecs.umich.edu, have explored ways in which computing and communications technologies bring constructivist, project-based pedagogy to science classrooms. The group has developed cutting edge tools such as Artimis—named for the goddess of the hunt—to help students do science-related online searches and keep track of previous searches; and Symphony, an integrated Web-based suite of planning, data collection, and modeling tools. Soloway has joined with colleagues to form a company called Learner-Centered Technologies, to market products including "Model-It" software that creates dynamic representations of complex systems such as watersheds, and PiCoMap for students to develop "concept maps" using Palm PDAs. —*OED*

David Thornburg

He explores **what's happening now and what's on the horizon** with educational technology

Of all the workshops on emerging technologies and their impact on learning that David Thornburg, 58, has presented, Jamming as a Pedagogical Model comes out on top. "We go through and analyze what musicians do in a jam session, then show that each characteristic makes sense in the classroom," Thornburg explains. For example, jamming requires multiple people, and the best learning is accomplished through collaboration. Thornburg discusses how peers can use the Internet to create workgroups

David Thornburg

and collaborative projects.

As the guitarist in the Silicon Delta Blues Foundation, Thornburg has performed songs that poke fun at everything from the Silicon Valley culture to school networking ("Goodness Gracious, Great Balls of Wire").

But Thornburg's passion for learning is no laughing matter. As the *founder and director* of global operations for the Thornburg Center, he conducts research and provides staff development in the areas of educational futures, multimedia, communications and whole mind education. Splitting his time between his homes in Illinois and Brazil, Thornburg helps educators explore the ways technology is changing the face of learning. "A lot of what we focus on today is taking a look at the skills students need when they leave school in order to take part in the global economy," he says.

In addition to his consulting and speaking, Thornburg is involved in shaping federal education policy as a Senior Fellow of the Congressional Institute for the Future. Although he says his thoughts could be different in six months, Thornburg believes the future shows every student having a computer that looks like a Gameboy—fully wireless with high-speed Internet access and retinal projector glasses to improve the display. —*ME*

Robert Tinker

He originated the idea of **using probes in computer-based laboratories** for real-time learning

Bob Tinker, 60, has been a pioneer in the innovative use of technology in education for more than 30 years, and he originated the idea of using probes—such as motion detectors—in computer-based laboratories for real-time learning. His group at TERC, www.terc.edu, developed probeware that is now widely used in physics and mathematics courses, as well as for the Voyage of the Mimi project, and did the first NSF-supported research on the use of probes in education.

In 1985, Tinker invented the idea of teaching science through having students gather and share data over e-mail networks, which resulted in the National Geographic Society Kids Network, the first curriculum to make extensive use of student collaboration. The NGS Kids Network introduced hundreds of thousands of students and teachers to computers, networking and genuine science, and led to the development of the Global Lab and GLOBE projects, and LabNet, an early use of networking to support teacher professional development.

Six years ago,Tinker started the non-profit Concord Consortium, www.concord.org, to conduct educational research and develop applications for portable and handheld computers, online courses for teachers and secondary students, sophisticated simulations, and technology-rich education environments. The best known of these projects is the online Virtual High School, which currently offers more than 200 courses to high school students throughout the country. —*OED*

Robert Tinker

Al Weis

His non-profit organization **recognizes students who collaborate** while building award-winning Web pages

Sometimes the best ideas start simply. In 1986, eventual ThinkQuest founder Al Weis, now 63, remembers sitting on a national panel that was studying how to bring the Internet into colleges.

"If this thing [the Internet] is good for universities, we ought to get it to K-12," he remembers saying to Ken King, president of Educom.

Six years later, after he had sold his business to AOL, Weis and King revisited his idea. What they came up with was ThinkQuest, the now global network of students, teachers, parents and technology experts. Students work in teams to research curriculum topics and publish their work as an educational Web site to be used for research throughout the world.

Al Weis

Students go through the entire product development life cycle while creating these pages, from doing market research to testing the site to make sure it works to registering the site with search engines. "They don't know it, but one day [this information] will be very useful for them," Weis says.

The site also promotes collaboration, sometimes with students on the other side of the world that speak a different language. "Teaching people how to collaborate is important and you don't learn that in schools," he adds.

Out of an annual contest that draws more than 10,000 participants, ThinkQuest has created an archive of more than 3,000 Web sites at thinkquest.org that draw more than four million hits per day. —*WD* **D**

Teaching, Learning, and the Transformation of Knowledge

By Fred D'Ignazio

Schools need to change dramatically over the next few years—but not by merely buying new computers and building expensive new classrooms.

Real, permanent, *necessary* change must come from within. Internal, structural changes must include: How teachers teach; how students learn; how classrooms are managed; how knowledge is structured; and new ways for teachers and students to *construct* knowledge every day on an accelerated, intense, quick-and-dirty level. Some core instructional methods for achieving the above goals are:

- Dramatic restructuring of curricular knowledge through the transformation of curriculum from linear text delivered by third-parties to interactive multimedia constructed "just-in-time" by student and teacher explorers in the classroom.
- Collaboration. (Shared minds to solve the hyper-complex problems of the 21st Century.)
- Pride of authorship. (Learning through authoring.)
- Constructionism. (Learning by assembling meaning from pieces of reality—multimedia data types—that are all around us.)
- Disappearance of old teacher and student roles.
- New roles for the teacher: Classroom manager, author, explorer, enthusiastic learner, electronic curriculum designer, ad hoc explorer-team member, guide, scout, motivator, coach, "go-for," and inspiration.
- New roles for the student: Co-teacher, co-manager, technology consultant, technology troubleshooter, multimedia plumber, investigator, researcher, explorer, author, publisher, presenter, electronic curriculum developer, peer coach, nurturer, trainer.
- The classroom can no longer be a controlled, risk-free, information-sparse environment. Instead, it must be an "Outward Bound" wilderness environment that allies teachers and students in collaborative teams who tackle their assignments knowing that time and resources are scarce and inadequate; that information is constantly flooding in, changing, and difficult to interpret; and that maximum quality and productivity can be accomplished only if all persons collaborate and focus on team process as the number #1 outcome.
- The classroom and the school must become an *innovation and transformation engine:* An environment for constructing knowledge locally (real-world investigation) and globally (through electronic-highway information) and by inspiring its participants to constantly learn, train, and grow through the constant editing, organizing, and sharing of knowledge across the classroom, around the school, and with parents and the local community through online, just-in-time training, research and publishing activities, experiments, demonstrations, challenges, and reports.

None of these ideas is far-out, fluff, or an expensive luxury. All elements are essentials to survive and be successful in the "Lean and Mean" 90s. We must be equipped to cope with rampant, radical growth and change in technologies; harsh, global competition; large-scale socioeconomic changes in our country; surprising shifts in popular culture; multi-culturalism and neo-tribalism; and job layoffs, job insecurity, and overnight job changes.

Our goal as teachers should be to spawn excellence in the classroom—not as an occasional surprise but as a daily, group goal for ourselves and for every student in the room. Sustained group and individual excellence stems out of the philosophy of *teacher explorers.*

Teacher Explorers

In a teacher explorer classroom, adults and young people share a *joint* responsibility to:

- Self-manage the classroom and make it run smoothly, humanely, harmoniously, and at maximum performance.
- Explore, learn, investigate, research, experiment, edit, think, speak, listen, converse, debate, read, and write.
- Teach, nurture, coach, share what they know.
- Concentrate on human-centered growth, innovation, and transformation as the most important classroom goal.

Most of what is learned is constructed by the teacher explorers themselves out of local (real-world, school, community) and global (electronic, multimedia) research and investigation and connected to the original curriculum in terms of desired outcomes and curriculum goals.

Young people in this setting become *con-*

tent specialists and *technology consultants*. Adults in this setting become *process specialists* whose primary goal is to inspire the best group and individual process in the classroom; and *resource managers* whose job is to scavenge the resources needed "just-in-time" for excited groups of students working collaboratively as *knowledge construction crews*.

Young people investigate materials and share new knowledge as they uncover it using a wide array of multimedia research and publishing tools. Young people work as technology *SWAT teams* (Student Work Accelerated through Technology teams) to set up technology equipment, operate it during class hours, troubleshoot it, guarantee its safety and security, train adults, and design electronic curriculum materials for classroom use.

Teacher Explorer *assessment* can be symmetrical and mutual (teacher-student) and can be conducted using new multimedia tools to measure the entire group (adult-young people's) success in collaboratively promoting maximum learning, growth, and productivity for all persons in the *community*. The object of the tools is to measure group and individual performance, not just mere knowledge. The tools evaluate the quality of performance reflected in a summation of an adult or young person's work over a given period (nine weeks, semester, year, etc.). The work is collected in the form of a Teacher Explorer Portfolio. Both for young people and adults, such a portfolio might include examples of individual and group:

- Writing (paper/disk), measuring written-communication skills.
- Visuals, graphics, diagrams, photos (paper/tape/disk), measuring image-communication skills.
- Digital audio (tape/disk), measuring musico-linguistic communication skills.
- Videos (tape/disk) measuring whole-person performance.
- Multimedia databases (disk/paper), measuring teaching/content linkages, connections, analysis, points of view.
- Multimedia simulators (disk/tape), measuring teaching/ content/process mastery.
- Experimental prototypes (disk/tape/real-materials), measuring design/engineering/ construction skills.

The chief goal of all products is to measure *classroom process*. The products are a *multimedia mirror* of the process of learning, teaching, and personal transformation that occurs in the classroom on a regular basis.

Some of the products can also be regarded as classroom-constructed *interactive teaching materials* that motivate, inspire, and inform young people and adults and enable them to "transition" today's classroom into a *community information, teaching, training, and transformation center of tomorrow.*

The acid test for all classroom materials will be to invite members of the local community—primarily parents, local business people, and representatives from local government—into the classroom for student-led training. The classroom teacher's and students' overall grade depends on the effectiveness of (1) the training experience, (2) the training teams, and (3) the training materials devised by the classroom's teacher-explorers (teacher and students working together).

Expert in a Box

New ideas can best be transferred into a school if they are combined into an "integrated solution"—a system that includes hardware, software, training, motivation, and reference materials *all in one package*.

We must use the most promising interactive training / transformation system to deliver this solution (e.g., DVI and QuickTime *instant digital video*. Some instant digital video modules need to be developed up front, but the bulk of the modules can be developed by cadres of teachers and students using their classroom multimedia station or more expensive "souped-up" multimedia-publishing tools in the library media center/ TEC center.

The idea of the digital-video "expert in a box" or "trainer in a box" is not far out; rather it is a necessity in the downsizing, budget-conscious, personnel-scarce yet technology-saturated schools of the nineties. It is also the latest way of packaging "the author's voice" in the most interactive, humanlike, and lifelike medium available.

All of the classroom training modules will be seminars that appear in the format of a multimedia database. Teacher explorer stations can be complete hardware/software/ training/transformation *kiosks* integrated into one platform, so the stations come fully loaded with the initial databases on board. Later, as student-teacher cadres create new databases and enrich older databases, they can transfer these databases onto CD-ROM discs. (It is possible to get the CD-ROMs mastered cheaply since classrooms will not need them in quantity.)

This new restructured classroom of the future can be built with simple, relatively inexpensive building blocks:

1. *Just-in-Time Trainer* Digital Video Interactive Modules to inspire, inform, train.

2. *Teacher Explorer Kiosk:* A teacher/student workstation, presentation station, bulletin board, one-computer-classroom research & publishing station that comes equipped with a video camera, computer, music/sound card, modem, network card, Quicktime or DVI, printer, CD-ROM drive, and active-matrix LCD panel.

3. *Teacher Explorer Center:* A multimedia learning lab/library of the future that regions and states can set up as a launch pad for cadres of "train the trainers" evangelists to go out and spark school districts and educators in their regions. As the next step, school districts can be encouraged to set up their own TEC library/labs in their buildings to inspire and train school teachers and staff. School buildings can be encouraged to set up a TEC center as a library of the future (that functions alongside and interacts intensively with the current print-centered library). The library media specialist can offer the TEC-wing of the library "after hours" as a staff development classroom, curriculum-development center for teachers, as an electronic-publishing center for students, and as a community training center for local businesses.

4. An *organizational-change training plan* that arms "train the trainer" cadres with their own portable Teacher Explorer Station in a briefcase or on wheels that functions as a mobile "starter kit" of tools and templates that teach how to set up a TE station, how to set up a bare-bones TEC Center, and provides a initial set of "Expert in a Box" modules that act to inspire, motivate, and train teachers in the larger philosophical ideas that underlie the process of teaching, learning, and transformation of knowledge.

Student consultants and evangelists can push the portable kit around the school building. Teacher evangelists can carry the kit to other school buildings and take the transformation process "on the road" to reach the widest group of people and spark discussion. The teacher and her cart act as a "welcome wagon" to invite additional teachers and students to participate in this thrilling new process.

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Multimedia Sandbox

Edited by Fred D'Ignazio

Restructuring With Technology: A Proposal for Student Inservices

By Fred D'Ignazio and Sharon Goth-Tew

At the Teacher Explorer Center, a national training center in East Lansing, Michigan, we have trained over 3,500 teachers, students, parents, and administrators in a one-day immersion course that uses multimedia technologies to support new teaching strategies, including cooperative learning, thematic inquiry, and whole-language publishing.

Teachers who emerge from our intense, accelerated program are thrilled by their accomplishments and proud of the multimedia essay that they and their team create in the brief six hours they spend in our center. But they are also doubtful that they could replicate the same process with students back in their classroom.

Here are some of their comments:

"It would take me years to learn enough about this stuff to teach it to my kids."

"I wouldn't know where to start."

"There's not enough time in the day to do this."

"I might do this once. But I'd be so burnt-out I'd never try it again."

"The cabling's a nightmare."

"I'd be afraid to let my kids touch this equipment for fear of breaking it."

"This multimedia is ideal for gifted and talented kids. Or maybe for kids in special-ed or industrial arts. But average kids ... no way."

"I wouldn't dare try this again unless I had an expert right by my side every step of the way."

A Sony Salvation?

All of the comments above reflect legitimate teacher concerns and fears. After all, if the teacher is expected to run the classroom, *top-down*, then multimedia is a terrifying prospect. Computers alone were frightening and intimidating. Now computers are being joined by a menagerie of other black boxes, including VCRs, TVs, camcorders, CDs and CD-ROMs, modems, LCD panels, video projectors, digitizers, scanners, and dozens of other mysterious devices that seem to roll relentlessly out of Japanese factories and into our daily lives.

But what if the teacher turned things upside down and used these new devices to experiment with new styles of teaching and new strategies for classroom learning?

What if the teacher began this restructuring process by giving students responsibility for the safety and operation of these tiny electronic boxes. What if the kids' management of these multimedia tools of learning gradually trained them to manage learning itself?

Perhaps this is the opportunity that many teachers have been looking for—the chance to evolve their classroom to a more collaborative, self-managed environment that gradually transfers vital teaching responsibilities to people they respect and trust—*their students*.

Nintendo Boot Camp

Students are ready to assume these new responsibilities—if only their teacher will give them the chance.

A generation of American students has been quietly undergoing advanced training in multimedia systems and in the multimedia transformation of knowledge.

Where is this training taking place? Not in the Persian Gulf. Not in Hollywood. Not on Madison Avenue.

Where? *In kids' bedrooms*. Our kids have spent the last five years in Nintendo Boot Camp, in the privacy of their bedrooms, dens, and family rooms. They have mastered advanced cabling skills, manipulated real-time, three-dimensional databases, and navigated through complex, multimedia simulations. And all the while we thought our kids were just playing video games.

According to Jim Dezell of IBM, the new knowledge of the 21st century will be created and communicated on multimedia computers. If this is true, then our young Nintendo jockeys are future computers' first masters, pilots, and pioneers. After all, what is a Nintendo machine, if not a primitive multimedia computer?

It's time we gave these Nintendo-trained kids the responsibility to replace the *Nintendo curriculum* with subjects that have substance, such as literature, history, art, science, mathematics, and language.

A Call for Student Inservices

An exciting, effective way to tap students' vast aptitude and training in these post-Nintendo skills is to enlist them as "trainers

of trainers" in student inservice programs organized in each school building.

For years we have created inservice programs devoted exclusively to adults. Yet adults are notoriously disabled in technology-related areas and enormously resistant to the formal acquisition of technology-related skills. Because of our fixation on adults we have almost missed the truly receptive inservicing population—*students*. Students are marvelously swift learners. And students who learn with the goal of inservicing other students learn even faster!

One Hour and Five Minutes

At the Teacher Explorer Center, we have created a remarkable, accelerated learning environment (using the tools of cooperative, self-paced, self-directed learning). As a result, adults make extraordinary progress during the workshop. They typically start the day with only a smattering of computer skills and a Pandora's box stuffed with fears and inhibitions about the tools they are expected to use. The miracle is that by the end of the day, these same adults emerge, puffing, panting, and exhausted, but clinging to a newfound joy of learning and a videotape that makes them glow with pride.

The Teacher Explorer Center's primary mission is *teacher training,* yet it has also trained hundreds of students.

We have had teams of students ranging from the second grade through seniors in high school. On its surface, the students' workshop follows the same program as the adult workshop. Except:

With the students we remove the adults' detailed workshop "cookbook" and replace it with brief, oral instructions from the instructor.

And we ask the students to create a multimedia essay that is twice the length of the adults' essay.

And we ask the students to write a script and orally narrate their script along with a musical soundtrack and dub the script and the soundtrack onto a videotape overlaying laser video segments and animated computer graphics.

And we tell the students to create the essay on subjects they are studying in their classroom.

And, last, we instructors become especially perverse and hide in our back offices and expect the students' classroom teachers to manage their student teams and deliver their multimedia productions on a deadline.

And, you know what? *They do it!* They create fabulous multimedia essays on volcanoes, space exploration, dinosaurs, Canadian geography, the American Civil War, endangered species, tropical rain forests, and dozens of other subjects.

How long does it take them to crank out their essays?

On the average, a student team (composed of seven-year-olds or high school seniors) takes about *SWAT* to create a curriculum-based multimedia essay.

(The fastest group of students was a team of sixth graders from Pinconning, Michigan that finished the entire project in an hour and five minutes.)

The average student team completes their essay in one third of the time it takes the average adult team.

And when the students cross the "finish line" and show their essay to the entire class, they aren't even breathing hard.

So we turn them loose and they compose another essay before lunch.

> What if the kids' management of these multimedia tools of learning gradually trained them to manage learning itself?

SWAT Teams of Student Trainers

Each school building can harness its students' prodigious multimedia aptitudes by identifying individual students who would like to become student trainers. District technology coordinators and curriculum directors can schedule *student inservices* to train a cadre of students who can return to their classrooms and train other students.

SWAT teams of student trainers could be "loaned" to different classrooms to perform inservices for other students. Newly trained students could train still more students. At this rate, the number of trained students would multiply geometrically.

Does the process of student inservicing ignore the teacher?

Not at all. Student inservicing gives teachers a new "gentle" way to become proficient in the new technologies. Our student workshops at the Teacher Explorer Center have demonstrated that even a teacher with no prior technology training can manage student teams who are turning out multimedia essays. And as teachers work with the students, they gradually acquire technical skills at a pace that makes them feel comfortable.

Teacher-to-teacher inservicing can now be replaced—or at least supplemented—by *student-to-teacher* inservicing. This inservicing is what the experts refer to as "just in time learning." It is deeply embedded in the curriculum. It occurs while the teacher is on the job. It doesn't remove a teacher from the classroom. And it doesn't require the district to spend scarce resources on teacher substitutes.

Multimedia Clubs

Student-to-teacher inservicing is an amazingly fast way to bring teachers up to speed with new technologies. In Jefferson County, Alabama, we began a loose-knit student inservicing program based on *multimedia clubs* organized after hours by teacher and parent volunteers. The multimedia clubs were an instant hit with students and soon produced dozens of highly trained student trainers who returned to their "daytime" jobs to train other students and, eventually, other teachers.

A federal study team from the U.S. Congress visited the Alabama teachers a year after the multimedia clubs had started and found that the small cadre of 25 teachers who had been inserviced via standard workshops had blossomed to an amazing 125 multimedia enthusiasts who were so evangelical that they drafted homemade bumper stickers that proclaimed, *"Stop Teacher Burn Out. Start a Multimedia Classroom."* And they carried home computers, camcorders, and VCRs on weekends and held *multimedia slumber parties* to create lessons Monday morning on pronouns, prefixes, and the Pythagorean Theorem.

Restructuring Classroom Learning

The strategy of tapping students' multimedia literacies through student inservicing is a practical technique to accelerate the integration of technology into the daily curriculum. It is also a surefire method to *restructure classroom learning* in a manner that motivates students and is guided by teachers. It dramatically increases student participation in classroom lessons and gives teachers wonderful opportunities for personal and professional growth.

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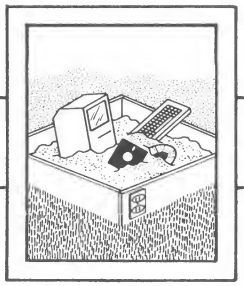

Multimedia Sandbox

Fred D'Ignazio

Getting Started with Multimedia: 16 Classroom Management Strategies

by
Fred D'Ignazio

In the September and October "Sandbox" columns we explored one strategy for keeping multimedia inexpensive—scavenging and scrounging equipment from around the school and assembling it into a multimedia center that can be wheeled from classroom to classroom. Is there a similar approach that makes multimedia simple and glitch-free? Probably not. And such an approach might not be a good thing. Multimedia is a challenge. As a challenge, multimedia can be an opportunity to experiment with new methods of classroom organization—new methods that might increase students' productivity and engagement in the learning process.

Educational researchers are talking about moving from a teacher-centered classroom to a student-centered classroom, a classroom where a teacher is no longer burdened with the overwhelming responsibility of delivering all knowledge and with the impossibility of being the source of all right answers. No human being has enough fingers to press all the buttons, enough expertise to master all the myriad components of multimedia, or enough time to look after all the scrounged equipment. The solution? Call on your fellow teachers and enlist the aid of your students.

Your fellow teachers can form a *support group* to help you cope with multimedia in your classroom. They can help you train students to run the equipment, and they can help you troubleshoot your way through your early multimedia units. Working closely with your colleagues makes it clear that: (1) no one can know everything about multimedia; (2) in fact, often no one knows what to do next (so everyone is free to guess and improvise); and (3) everyone can make a contribution in multimedia.

The same philosophy applies to students. As you know only too well, your students all have different styles of learning. Some are linguistic learners, others visual learners, auditory learners, kinesthetic learners, and so forth. Some are aggressive learners, others timid; some are social and verbal learners, others solitary and silent. The neat thing about multimedia is that it offers an arena for *all* types of learners to succeed—even the marginal learners on the fringes of your class (the troublemakers, emotionally conflicted, learning disabled, the bored, burnt-out, and disengaged).

The key to involving all your students is to set up a structure for self-management. You make it clear up front that if your students abide by this structure they can create multimedia publications and presentations. Make it equally clear that if they abandon this structure then it will be impossible for your class to continue experimenting in this area. Let them know that you need their support since there is no way one person (even a teacher!) can manage multimedia alone. You are turning to them because you trust their good sense and value their creativity, energy, and ingenuity. Tell them you expect learning to be a two-way street; sometimes you will be teaching them, other times they will be teaching you. Tell them that you will play the part of an eager learner, and you expect them to start thinking like "apprentice-teachers."

Here are 16 strategies you can choose from as you plan your first journeys into multimedia. These strategies come from other classroom teachers who are seasoned multimedia explorers. The strategies were picked because they work. However, some strategies may be more appropriate than others, depending on your classroom's unique mixture of students, resources, schedules, and demands.

1 Students as Multimedia Researchers

Focus on a simple method for dealing with multimedia. One successful method is to view students as doing multimedia research (assembling words, images, sounds, etc.) on subjects they are studying in class. This approach allows you to "niche" multimedia into your current schedule and confine it to times already designated for students' written and oral reports. The students continue to do reports, but now you allow them to come to you with *proposals* to turn the reports into multimedia presentations or publications. You help the students prepare their proposals, but you scrutinize

the reports carefully just like any good director of research to make sure they follow imaginative, independent lines of inquiry, and, most of all, are *doable*.

Get the students started brainstorming, planning, organizing, writing, and scheduling their projects *long* before the equipment arrives. Anticipating using the equipment is a big incentive for students to write, plan, complete their lessons, and do their homework. Use this incentive effectively so students will be prepared to get the most out of the equipment when it finally shows up.

Team/Project Method of Organization

Organize your student researchers into teams of multimedia explorers, problem solvers, reporters, authors, and producers. Work with your students to develop model contracts for teams to sign before they are allowed to participate in multimedia.

Cooperative Learning

Organize your student teams into peer-tutoring groups where everyone learns, shares, and makes a contribution. Cooperative learning can maximize team *and individual* performance in a collaborative, noncompetitive environment.

Critical Thinking

Multimedia is filled with opportunities to develop critical thinking skills. Encourage your students to figure things out for themselves (as individuals and teams). Encourage the teams to experiment, be innovative, and improvise.

The Learner Accepts More Responsibility

Encourage your student teams to be self-reliant, take risks, be independent, and manage themselves with little direct supervision. Many teachers have used this approach to gradually go from a classroom with no teacher aides to a classroom with 25 teacher aides!

Interactive Presentations & Publications

Challenge your students to create interactive reports and presentations. Multimedia is not just a slick way to create one-way, passive, frozen reports. The presentations' outcome should not be fixed or always predictable. Encourage your audience to engage in inquiry, investigation, estimation, hypothesis formation, and hypothesis testing. Spark lively discussions in which your students' performance is measured by their ability to clearly communicate their ideas and stimulate their fellow classmates' thinking.

Thinking About Learning Strategies

Think about organizing *shadow teams* of students to follow their classmates and record their progress. Encourage students to think about strategies of inquiry and what works for each team and for each individual. Have students tape each other frequently, and give students the opportunity to see themselves on camera often. A teacher can tell students to change their behavior, but it is much more effective for students to watch a videotape of their behavior. The videotape lets them see themselves as others see them and hear themselves as others hear them.

Modularity of People & Equipment

The multimedia center can be divided into separate components (video, audio, printing, slides, etc.) among different student teams. You can also divide your students into teams which specialize in research, script writing, planning, publishing, and presenting. Students might further specialize in graphics, video, music, digitizing, narrating, or directing. Encourage each team to borrow "experts" and expertise from other teams. Promote spontaneous and impromptu cross-team collaboration.

The Sandbox and The Explorer as Metaphors

Think about the power of these metaphors to transform the learning environment and to encourage students to self-manage their learning. Multimedia lends itself to learning through metaphors. You and your students should think up fresh, new metaphors of your own.

Teachers as Explorers

Teachers, too, should have plenty of opportunities to play in the multimedia center and go on multimedia explorations (with students and with fellow teachers). Teachers should explore, report back, publish, and present.

Multimedia exploring can redefine the teacher's relationship with students and with old subjects in the curriculum. Teachers and students together can breathe new life into dry, textbook descriptions of knowledge and transform them into movies, radio shows, video skits, multimedia experiments, expeditions and safaris into the local community, and interviews with local "eyewitnesses" to history.

Teacher-explorers and student-explorers can share multimedia responsibilities, learning from each other.

Multimedia on Wheels

Equipment can be placed on *low*, wheeled carts to encourage multimedia to go where it is needed and wanted. Under direct teacher supervision, students can push carts around school. At night the carts can be housed in a book room, supply closet, or in the media specialist's equipment room.

Use Multimedia to Document "How To"

Student explorers and publishers can tape each other during projects to create "video manuals" that document each new technique or skill that is mastered. Using desktop publishing, students publish manuals, quick-start cards, multimedia cookbooks, recipe books, lists of tips and tricks, and "how-to" guides.

13 Carve Out Niches—Break Complex Subjects into Pieces

As explorer teams journey into new areas of knowledge, they do research, experiment, publish, and report back. Teams carve out niches as "experts" in a small domain. Teams develop a sense of pride and ownership toward this domain. Team members teach each other about the domain, then present to other teams and teach them through "maps"—e.g., how-to videos, how-to guides, handouts, and slide shows.

Teams then move on to explore *new* subjects, projects, and domains. In this gradual way, large, complex subjects are gradually explored, and areas of ignorance ("the wilderness") are whittled away. Students' self-esteem rises as they see themselves as scouts, mapmakers, and trailblazers into new areas of inquiry.

14 The Teacher as Wedding Photographer

The multimedia teacher floats among teams acting as troubleshooter, giving encouragement and mini-tutorials, encouraging group process (critical thinking, cooperative learning), and helping students model their behavior as *teacher apprentices*. The teacher models a good learner.

The teacher plays the part of an invisible "wedding photographer" and records highlights of students' efforts and students' progress on videotape. The teacher replays the videotape for individuals, for teams, and for class discussion.

15 Video Report Cards

Each student buys one blank videotape at the beginning of the year. (The teacher can look for videotape sales and discounts and buy quality—Kodak, TDK, Scotch, Fuji, Maxell—videotapes, in bulk, for under $4.00 per tape.) Students tape each other at the beginning of the school year to record each student's current communication skills, self-esteem, knowledge of content areas, and so forth. Students tape each other *before* and *after* each major project. Students tape each other at the end of the year to measure final skills, knowledge, etc. Teacher and students edit tapes together to create a BEFORE and AFTER record of each student's progress during the year.

The tape becomes a personalized *video yearbook* or *video portfolio* for each student. Students take the videotapes home to show parents. Teachers show excerpts from the tapes at Parent-Teacher conferences as a supplement to formal report cards.

16 The Learning Helix

Think of the classroom as a stage or studio in which students are constantly exploring, researching, publishing, presenting, and interacting. When students learn something new they must immediately show what they know as individuals and as a team. (At MIT, this is called RPS—the "Rapid Prototyping System.")

At presentation time, group the student teams in a circle. Have each team present to the entire group, then turn on the video camera and videotape the team which follows it. After each presentation, teams do self-critiques and everyone thinks up creative ways to improve the presentations.

Each team in the circle *immediately* tries to incorporate the latest suggestions into their presentations. The learning circle becomes a learning helix and the students' learning curve goes almost straight up!

Coping with Multimedia

Remember, all these ideas are simply strategies, not formulas for success. They were invented by teachers like yourself who were trying to cope with the challenges presented by multimedia. Modify what doesn't fit, and invent some new strategies of your own. Above all, hang in there and survive. Practice your coping skills and pass them on to your students. As one group of multimedia teachers said: "Blessed are the risk-takers for they shall surely accumulate experience." The multimedia classroom is an exciting, challenging, exhausting, and exhilarating place to practice teaching and learning. And the results—both for you and your students—are well worth the effort.

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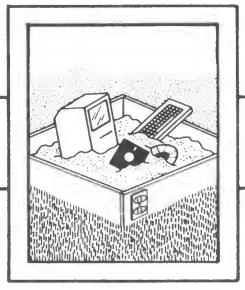


Multimedia Sandbox

Multimedia Copyright

by
Fred D'Ignazio

This month's column is supposed to be a shopping list for multimedia equipment on several computers. Unfortunately, assembling this list has proven to be far more time-consuming than I anticipated. As a result, I will publish the list in installments. This month we will look at how students can become responsible multimedia authors. We will also list a few of the items you will want to look into if you are building a multimedia center around a Commodore Amiga computer.

Copyright and Fair Use

Students who become multimedia authors and explorers must learn about the copyright law and the legal, fair use of copyrighted material. There are great riches in the published and broadcast media (e.g., news programs, TV documentaries, magazine pictures and articles, books, plays, movies, etc.). Nevertheless, a student author must learn how to use the media in a manner that is ethical, moral, legal, and intellectually responsible.

If you are planning to experiment with multimedia or build a multimedia center with your students, I recommend that you start the experience by devoting a week or two to preparing your students to become multimedia authors. You and your students should take a brief look into the history of media, the economics of media, and the role of authors (performers, composers, lyricists, poets, screenwriters, producers, etc.) in the different media. It is important at this point for students to discuss what it means to be an author and how important it is not to violate the rights of fellow authors.

Later, when you actually begin multimedia publishing, here are some strategies to follow with your students:

1. **Do It Yourself**
   A teacher should encourage his students to create all sounds, images, and text for their publications *from scratch*. This puts a premium on students' creativity and ingenuity. It encourages students to be imaginative and original in their use of language, imagery, and sound. It also protects a student from being guilty of plagiarizing or infringing on someone else's published work.

2. **Give Credit**
   A good example for a student author to follow is the *bibliographic footnote* in a report or term paper. Student authors who use someone else's published work —songs, photos, words, TV programs, movies, etc.—can create a *multimedia footnote* which gives full credit to the published author, the publication in which the author's work appeared, the manufacturer or publisher of the work, the date of publication, the location of the publisher, and the location of the portion extracted by the student for use in his work.

3. **Borrow Sparingly**
   Even when a student gives credit, he must never use more than a few sentences from a printed work, a few seconds from a song, or more than ten to fifteen seconds at a time from a videotape, TV broadcast, or radio show. The portion of the work that the student borrows should be a small percentage (under 5%) of the total published work.

4. **Don't Charge Money**
   Never charge money for any student work that incorporates portions of previously published songs, TV programs, books, etc. (This is the one place where teachers have been successfully prosecuted for violating copyright law!)

5. **Stick to the Curriculum**
   You are safe from prosecution as long as you and your students create works for students' *educational projects* related to their graded classroom work; as long as you "publish" your students' work in an educational institution (your school); and as long as a teacher is supervising the students' projects.

6. **Encourage Discussion**
   Encourage your students to discuss the

range of issues associated with copyright law. Bring up such issues as copying computer software and software piracy; copying popular performing artists' songs onto blank cassettes; copying movies onto videotape; copying broadcast TV programs onto videotape; copying an author's words without giving credit; photocopying books, newspaper articles, and magazine photos; digitizing book illustrations into a computer; digitizing persons' voices and music into a computer. Help students understand the ethical, intellectual, legal, and economic dimensions of copyright and fair use in light of new multimedia technologies.

7. **Draft a Student Author's *Bill of Rights & Responsibilities***
Issues of copyright and fair use offer a wonderful opportunity to encourage student authors to consider the ethical, legal, intellectual, and economic ramifications of borrowing another author's creative and commercial property. Plan a unit around copyright before you begin your multimedia publishing activities with your students. Then have the students work together as a team to draft a *Bill of Rights and Responsibilities* that student authors in the class must sign to make sure they are fully aware of the rich opportunities and the serious responsibilities associated with using previously published media.

8. **Take a Calculated Risk**
Copyright law is murky about rights and responsibilities in the coming era of "desktop multimedia." You could sit back and wait until the smoke has cleared and the laws are settled about what rights students and teachers have to copy videotapes, broadcast programs, records, tape cassettes, etc. But the cost would be enormous! These materials offer a rich storehouse of multimedia data, illustrations, examples, and ideas that your students should have at their disposal. In addition, there is immense educational benefit to students who can take mass-media products (TV, radio, records, CDs, etc.) and *repurpose* them into "raw materials" that they build into their own reports or presentations. These materials can greatly enrich the students' work, they can help the student communicate more compellingly to his fellow classmates, they teach the student how to produce media and not just consume it, and they encourage the student to develop the valuable thinking skills of *critical viewing* and *critical listening*. For these reasons, encourage your students to use media responsibly and to be alert to the effect of their decisions on authors who derive their livelihood from publication.

A Multimedia Center Shopping List

From time to time in the coming months we will see what kinds of hardware and software you might need to build a multimedia center around different manufacturers' computers. This month we feature the Amiga computer and its peripherals. These items are meant to be representative of the types of components you might need. The list is necessarily incomplete due to the rapid growth in this field. I would like to hear from software and hardware manufacturers whose products are not mentioned, and I will try to include their products in a more complete list in a later column.

An Amiga Multimedia Center

Amiga multimedia centers can be divided

into three levels. The beginning *Desktop Presentation* level is relatively inexpensive, and uses only the computer and a dot-matrix printer. The intermediate *Desktop Video* level is moderately expensive, requiring additional hardware. The advanced third level, a *Hypermedia Studio* capable of working with multimedia databases and telecommunications, requires substantial investment in equipment.

There are typically three uses of multimedia in the classroom:

- Teaching tool—a fancy audio-visual aid;
- Student multimedia textbook, or "courseware"; and
- Student browsing and reference tool (multimedia encyclopedia).

There is also a fourth way to use multimedia—as a teacher's and students' *Inquiry Center*. The teachers and students work together as "Explorer Teams" and use the centers to do research, investigating, publishing, and presenting. The hardware and software described below is especially designed to create inquiry centers in the classroom at the beginning, intermediate, and advanced levels. The Amiga is a good multimedia platform because it is a true "multi-tasking" computer. "Multi-tasking" means it can run several programs on the desktop at the same time. Multi-tasking allows a student or teacher to call up different programs (graphics, music, video, slide shows, etc.) and juggle them, link them, cut and paste—all on the desktop at the same time. This makes it easier to create multimedia presentations. There are some special features to note about this hardware:

- The Amiga has a monochrome composite jack out the back, so you can create a black & white TV picture or save black & white video on a videotape.
- The Amiga has two female RCA jacks out the back for stereo speakers.
- The Amiga has NO *color* composite-video output jack. This limits you at Level One to desktop presentations—creating graphics, slides, animations, and music entirely at the computer and presenting them on the computer. On the other hand, teachers and students can experiment with video by connecting the *monochrome* composite jack on the Amiga to the VIDEO IN jack of the VCR. This is good practice, and it lets the class create desktop videos. Beginning at Level Two the Amiga is fully wedded to video (thru digitizing, overlay, and sending Amiga screens to the VCR). I am calling this "Desktop Video" since you are linking the Amiga to video devices (video camera, VCR, TV).

Level One (Desktop Presentations)

The user can create colorful desktop presentations entirely on the Amiga computer. Presentations feature animations, electronic slide shows, sound effects, music, and text.

Computer

Amiga 500, 512K (up to 1Mb internal, 8 Mb external); comes with Workbench 1.3.2 (or 1.4) operating system, built-in 3.5" (800K) drive, mouse, Commodore 1084 monitor. $799.

Additional Hardware

Panasonic 1180 dot-matrix printer. $219.

Software

*TV*Show,* Zuma Group, $99.95. Integrates all the programs below into a single, multi-screen desktop presentation, complete with sound effects, music, special effects, and transitions between screens or "slides."

The Graphics Studio, Accolade, $49.95 (retail).

Instant Music, Electronic Arts, $49.95. Gives users a non-traditional (no musical scores, notes, etc.) method of composing and playing back music. Easy to create pop music, jazz fusion, classical, synthesized sounds, etc..

*TV*Text,* Zuma Group, Inc., $78.99 ($99.95 retail). Excellent text-manipulation program. Useful for presentation titles and credits. Can create all kinds of special effects with text (drop-shadows, 3D text, etc.).

Pen Pal, SoftWood, $149.95 (educational discount available). Word processing and integrated graphics.

Level Two (Desktop Video)

The Amiga links to the video camera and VCR. The user can create classroom documentaries on videotape on any subject in the curriculum. The computer provides special effects, sound effects, and music for the videotape soundtrack.

Computer

Amiga 2000, 1Mb internal (expansion to 8Mb internal), 7 expansion slots (internal), graphics slot; comes with Workbench 1.3.2 (or 1.4) operating system, built-in 3.5" (800K) drive, mouse, Commodore 1084 monitor. $1,899.

Additional Hardware

Panasonic 1180 dot-matrix Printer, $219.

External disk drive, $159.

Amiga 2300 genlock card, $350. Overlays computer graphics atop video. Outputs NTSC standard RS170 composite signal. Non-broadcast quality, but fine for school desktop video.

DigiView video digitizer (NewTek), $199. Plugs into jack on back of Amiga. Requires up to 1 minute to digitize image. Requires still image or blurs picture.

VCR / TV / Video camera.

Audio and video cables.

Software
Use software from Level One.

Level Three (HyperMedia Studio)

The Amiga links to video equipment, electronic keyboards, and other computers via modem. Users can create multimedia databases and presentations. Multimedia research projects can be undertaken with students in remote classrooms in different towns or states. Broadcast-quality video output can be achieved for less than $10,000. (In comparison, non-Amiga equipment that does the same job costs $70,000 and up!)

Computer
Amiga 2500, 2Mb of 32-bit memory, 1Mb of 16-bit memory internal, expansion to 8Mb internal, 40Mb hard drive, 7 expansion slots (internal), graphics slot; comes with Workbench 1.3.2 (or 1.4) operating system, built-in 3.5" (800K) drive, mouse, Commodore 1084 monitor. $3999.

Additional Hardware
External disk drive ($159).

The Frame Grabber video digitizer (Progressive Peripherals), $599. Captures video frames live, in "real time." Can capture successive frames every 5 seconds. Perfect for animation effects.

Magni 4004 video genlock board and encoder, $2000. Broadcast-quality TV video output. Overlays computer text, graphics, and animation atop video to create video windows, special effects, titling, credits, etc..

MIDI (Musical Instrument Digital Interface). Requires card, software, MIDI cables, MIDI keyboard.

MIDI Keyboard: Casio MT-540, approximately $300.

VCR / TV / Video camera.

Audio and video cables.

NEC Silent Writer printer, $3500. PostScript-compatible laser printer for professional desktop publishing.

Amiga 1680 modem, 1200-baud, $122.99. Enables students and teachers to do research using online information databases and to collaborate with other students and teachers in remote classrooms on joint multimedia research projects.

Software

Viva, $199.95, MichTron. Lets teachers and students create multimedia databases, publications, and presentations.

VTX, MichTron, $79.95. Communications program that works with Amiga 1680 modem.

Bars and Pipes, Blue Ribbon Bakery, $249.95; or *Deluxe Music Construction Set,* Electronic Arts, $99.95. Audio digitizing—allows users to capture and manipulate all kinds of sounds, including voices, music, and sound effects. Digital sound samples can be stored and inserted into multimedia presentations.

Professional Page, Gold Disk, $295. Desktop publishing program; works with NEC laser printer.

I hope this first shopping list gives you an idea of what it takes to create different levels of multimedia classrooms. Next month we'll take a more detailed look at an inquiry-based Classroom of the Future.

Software Suppliers

Accolade, 550 S. Winchester Blvd., Suite 200, San Jose, CA 95128.

Blue Ribbon Bakery, Inc., 1248 Clairmont Rd., Suite 3D, Atlanta, GA 30030.

Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404.

Gold Disk, Inc., P.O. Box 789, Streetsville, ON L5M 2C2, CANADA.

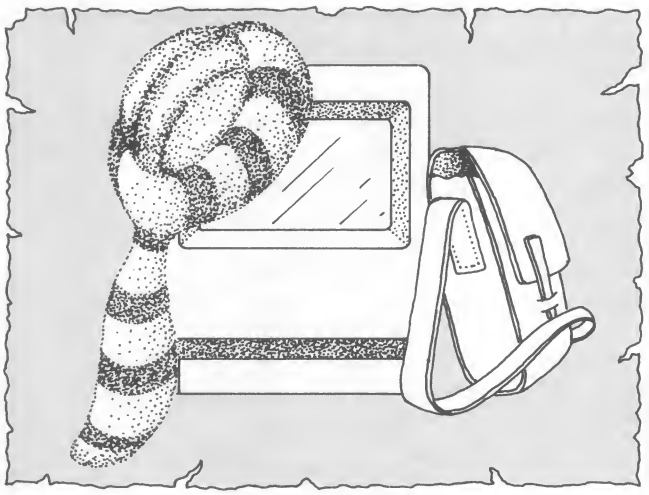
MichTron, 576 S. Telegraph, Pontiac, MI 48053.

Softwood Co., distributed by Brown-Wagh Publishing, 16795 Lark Ave., Suite 210, Los Gatos, CA 95030.

Zuma Group, 6733 N. Black Canyon Hwy., Phoenix, AZ 85015.

Multimedia Sandbox

Edited by Fred D'Ignazio



Teacher Explorers, Pioneers, and Settlers

By Fred D'Ignazio and Sharon Goth-Tew

New Roles for Teachers

The classroom of the future will be multimedia-intensive and technology saturated. Multimedia can help teachers and students design a new classroom curriculum of the future that is intensely interactive and motivational for all students, regardless of their background, experience, or learning style. Multimedia can lead teachers into new roles that are necessary to train our future adults, citizens, and leaders for the enormous challenges of the 21st century.

There is a great danger, however, that multimedia might be used to *seduce* students to learn intrinsically meaningless materials by coating them in powerful multisensory "infomercials." Further, there is a possibility that teachers' jobs will be *deskilled* as classrooms become more automated and as student-machine "learning moments" replace student-teacher learning moments.

In planning for a technology-intensive classroom of the future, educational policymakers should try to do whatever they can to:

- Enable, empower, and *enskill* their teachers through personal and professional growth experiences involving the use of technology in classroom applications.
- Make technology training primarily a *people-to-people* experience and not a narrow "button-pushing" experience between human beings and machines.
- Restructure the classroom work environment to look more like the workplace of the future so that young people and their teachers will be prepared for the highly challenging, technology-based world of the 21st century.
- Encourage students and teachers to engage in cooperative learning on a sustained basis in which daily projects are assigned under tight deadlines that require intense group interaction, critical and creative problem-solving, and frequent use of technology as a thinking and communication tool.

Teacher Training—The Problem

School districts around the U.S. are making strides forward in school improvement. However, in the area of instructional technology, they are still lagging behind other sectors of our society. In general:

- Most teachers do not use computers as instructional tools.
- Most teachers are not aware of the new tools in instructional technology, in particular, interactive multimedia, telecommunications, and electronic publishing and communication.
- Most teachers are not trained to use these tools, and their motivation to use them is either low or non-existent.
- Most teachers are not prepared to use these tools to their full potential, to restructure classroom learning, motivate classroom students (particularly those students who are at risk or who need special challenges or assistance), and bring the curriculum to life.

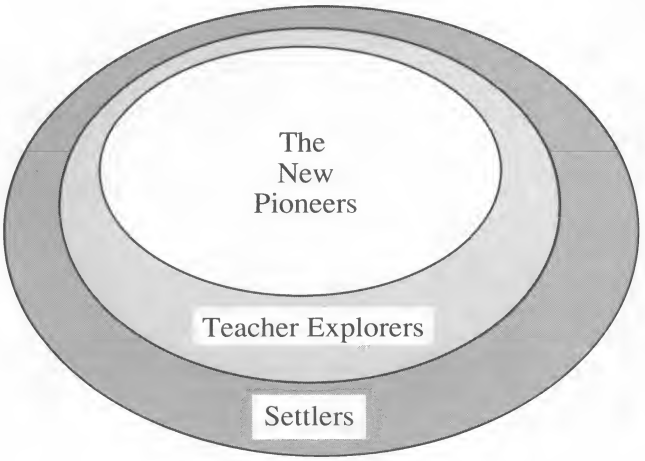
Teacher Training—Goals

School districts need to create a multi-year staff development program to make their teachers:

- *Aware* of new technologies that support instruction.
- *Motivated* to experiment with these technologies.
- *Competent* in using these technologies—in collaboration with fellow faculty members and students.
- *Able to* change classroom instruction and curriculum to maximize these technologies' benefit to students.

Proposed Training Model

In our last two articles in *The Computing Teacher,* we proposed that school districts consider opening their own Teacher Explorer Centers. The district center would be used to train teachers, students, and administrators in the newest interactive multimedia tech-



nologies and in ways teachers could use those technologies to restructure classroom learning.

We propose the following staff development model to districts that are considering setting up teacher explorer centers of their own:

The *New Pioneers* are the "early adopters" in a school district—teachers who have the courage or vision to immerse themselves in the new technologies right from the start. *Teacher Explorers* are those teachers who have taken one or more "exposure" workshops, but who have not had the time or resources to continue their training or to integrate technology into their daily lessons. The *Settlers* are the remaining teachers in a district who have still not received any training, but who, it is hoped, can be coaxed to "settle" the terrain now being explored by the Teacher Explorers and New Pioneers.

District Training Program—Core Components

School districts can use the above model to launch a multi-year training program that enhances the technical skills and leadership skills of the New Pioneers; that continues the training of the Teacher Explorers; and that converts the Settlers into Explorers and Pioneers. Specifically, the program should offer:

- A student multimedia course
- Follow-up training for New Pioneers
- The Open Lab—Teacher curriculum-writing projects at the teacher explorer center
- Curriculum-Writing workshops for Pioneers, Explorers, and their classes
- A "Technology & Learning" course for the Settlers
- A Student Publishing Lab—Scheduled by buildings and teachers in the teacher explorer center

Student Multimedia Course—The district organizes a middle-school and high-school course on multimedia learning. Students and their teachers use the explorer center as a "classroom of tomorrow," and create curriculum materials that can be used in other courses, such as math, science, and social studies.

The New Pioneers—The district compiles a database of all teachers who have received technology training and should contact these teachers to organize an informal users group entitled "The New Pioneers." The district makes the New Pioneers its highest

priority. It provides them with further training and helps them become leaders and models for other teachers in their building.

The Open Lab—The district's explorer center is scheduled as an "Open Lab" for Explorers and Pioneers to use for curriculum-writing projects for their classes.

Curriculum-Writing Workshops—The district offers afternoon curriculum writing workshops for Pioneers and Explorers—by subject area—and follow-up curriculum-design labs for their classes. The teacher workshops would take place on afternoons (3:30 - 5:30 PM); the student lab could be scheduled during the school day.

"Technology & Learning" Course for Settlers—The district offers its Settlers a 10-hour course on "Technology and Learning." The course could meet one afternoon a week, from 3:30 to 4:30 PM, beginning early in the semester.

Student Publishing Lab—The district schedules student publishing labs at the teacher explorer center. The district works with individual teachers to create multimedia publishing activities that are integrated into their curriculum-based assignments.

Training Outcomes—Year One

We are entering a period of enormous change for American schools. It would be unwise, to plan every detail before the process of change has even gotten underway. On the other hand, a district can commit itself to the following *outcomes* based on the above model for staff development:

- All district teachers and administrators will become more *aware* of the new instructional technologies that are available to them and the potential impact of these technologies on classroom instruction.
- One third or more of district teachers will become *motivated* to incorporate technology into their own classroom lessons.
- One third or more of district teachers will have *authored* a curriculum unit using technology.
- One fourth or more of all district students will have completed a *research and publishing project* in the explorer center, in their building multimedia labs, or in their own classrooms.

Teacher Roles & Education Reform

It is time to recognize that the myriad staff development programs now being offered teachers are confusing, time-consuming, and offer no coherent vision of what a teacher's role should be like in the classroom of the future.

These programs should be condensed, consolidated, and linked into a cohesive cluster whose mission is to give teachers new roles to lead their students and schools into the 21st century.

The American educational system needs to nurture its New Pioneers, expand the numbers of Teacher Explorers, and pave the way for the Settlers. The model for change proposed in this article offers a part for everyone to play. We can't all change at the same rate, but there is a *pace of change* best suited for each of us.

We all have a role in the classroom of tomorrow. It is a role that respects us as human beings. It is a role that encourages us to grow and do our best for our students.

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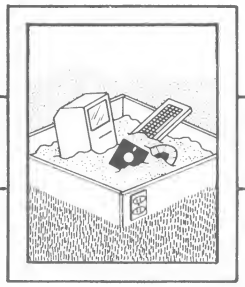


Multimedia Sandbox

Multimedia on Wheels

by
Fred D'Ignazio

Did you know that you can plug your computer directly into your VCR and "copy" computer images onto videotape? Did you know you can combine computer graphics with students' oral reports and record both on videotape without any expensive equipment? Did you know you can use an inexpensive musical keyboard to generate dramatic sound effects to enrich students' presentations? Did you know you can assemble a functioning multimedia center out of equipment found around your school plus an investment of less than a hundred dollars in software and cables?

You can do all these things. This article will get you started. Your ingenuity and talent for improvising will carry you from there.

Putting the Cart Before the CPU

The computer burst upon the world in the 1940s and was immediately labelled an electronic brain. Today, over forty years later, most people still limit that electronic brain to the processing of textual and numerical data. However, we are entering an era in which the computer will become more like a human brain in its ability to process not only words and numbers but images and sounds, spoken words, photographs, movies, and animated graphics. Soon every representation of human knowledge, civilization, and culture will be digitally encoded, stored in the computer's memory, and recalled and reproduced at a computer based workstation.

The age of affordable multimedia computing is not here yet. But you can begin to experiment with multimedia now using your trusty classroom computer. The solution is to put the cart before the CPU. The cart is a multimedia cart. We can simulate a multimedia computer of the future by scavenging equipment from around the school and placing it all on a rolling cart with a personal computer as the hub.

The cart is a multimedia research and publishing center. The center's three primary functions are to *capture* multimedia representations of knowledge, *process* these representations as multimedia data, and *publish* students' reports in the form of electronic slide shows, homemade books, movies, radio shows, and so on. The students' publications might appear on diskette, videotape, paper, or audio tape. They can be cataloged in the school library and checked out along with other library print and nonprint resources. They can also be loaned to students to take home to show parents and broadcast over local cable on the school district or public access channel.

Scavenged Multimedia

There are four immediate benefits in a scavenged multimedia center: (1) you and your students can begin experimenting with multimedia publishing *now;* (2) you can perform your experiments on a shoestring; (3) you are getting more use out of equipment you already have on hand; (4) you are discovering ways to *connect* the equipment into something larger—a research and publishing center.

Here is a scavenger's list of items you and your students should try to scrounge from around the school (or from your students' homes):

Video Camcorder
Tripod
Tape Recorder
Music Keyboard
Computer
Printer
Software
TV
VCR
Blank Tapes, Disks, Paper

You can hook almost all these items together using four cables and four tiny adapters, all of which you can obtain for a few dollars from Radio Shack. Lydia Edmunds' fourth graders at Vestavia Hills Elementary West in Birmingham, Alabama, named these cables "M.A.G.I.C. cables" and "M.A.G.I.C. adapters." The letters in "M.A.G.I.C." stand for **M**edia **A**ctivities **G**enerate **I**nvolvement and **C**reativity.

Here are the M.A.G.I.C. cables and adapters you'll need to get started:

- Four RCA dubbing cables (Radio Shack Cat. No. 15-1537)
- RCA-to-1/8" adapter (Radio Shack Cat. No. 274-378)
- RCA-to-1/4" adapter (Radio Shack Cat. No. 274-367)
- 1/4"-to-1/8" adapter (Radio Shack Cat. No. 274-047)
- RCA-to-RCA (innie-to-innie) adapter (Radio Shack Cat. No. 274-1553)

(An "innie" connector is the kind you can plug something into. An "outie" connector is the kind of connector that does the plugging. The CERT [Computer Education Resource Team] of Albuquerque, NM, came

Multimedia Cart

A cart is a mobile, multimedia research, publishing, and presentation center. If there is not enough space on one cart, you can divide the equipment into three carts to create an Audio Center, a Video Center, and a Desktop Publishing Center.

up with these terms as an alternative to the standard labels of "male" [for outies] and "female" [for innies].)

You'll also need a coax (F-connector) cable between your VCR and your TV. However, you probably don't have to worry about this cable since it comes with the VCR and is probably already hooked to the TV.

Multimedia on Demand

The beauty of the multimedia center is that it is mobile and on wheels. It can go anywhere, or it can stay away. Teachers invite it into their classroom only when they are ready to experiment with multimedia.

If you and your students create the center from your own classroom's resources, it can stay in your room full time. Or you might collaborate with fellow teachers to assemble the cart as a school-wide project. In that case you might enlist the help of the school's media specialist to house the cart in the school library or media center.

If the cart's home base is in the library, then the media specialist can stock the cart with the library's print and nonprint resources that pertain to curriculum units a class is doing. For example, if sixth graders want to do a presentation on whales, the school's media specialist can send the cart around with a research package composed of books on whales, a whale-watcher's guidebook, an audio cassette of whale songs, a National Geographic article on whales, Greenpeace flyers to "Save the Whales," pamphlets from Sea World and the local aquarium, and works of literature in which whales are mentioned, perhaps including selections from Herman Melville's masterwork, *Moby Dick*.

All the equipment and media resources needn't fit on a single cart. In some schools, the multimedia center is distributed across three carts. This approach makes the center more *modularized*. When the center visits a classroom, it can be divided into three components (e.g., a desktop publishing center, a video center, and an audio center) and three teams of students can work separately or together on a joint project.

Inventing Your Center

Think of the multimedia center as a LEGO® construction kit with building blocks, or as a Logo program with logical "primitives." The center's building blocks are the video camera, the computer, a keyboard, a VCR, a tape recorder, and anything else you can scavenge. Each multimedia center is unique; it is "invented" by a school out of equipment and resources it has on hand. There is no right way to hook together the different pieces in the center. Many different approaches have worked, and ingenious teachers and students are devising new techniques all the time.

A practical strategy is to group your students into cooperative teams that specialize in different parts of the center—video camera, sound, computer graphics, word processing, publishing, and videotaping. The teams act as a group of problem solvers who map out their areas, experiment with different techniques, and choose the best approach. Dozens of teachers have found that using critical thinking, experiential learning, and cooperative learning techniques at this stage result in student teams assembling a center and teaching its mechanics to their peers in a remarkably short amount of time (usually after only two or three afternoons of experimentation).

Before the teams begin experimenting, it is helpful for the teacher to outline the center's major functions (capturing, processing, and publishing) and the machines that perform those functions. This gives the students a visual "template" from which to build their center.

An Electronic Biography

Often a given curriculum application will determine how your students configure your center. For example, let's imagine that one of *your student teams decides to do a life*-and-times biography of Dr. Martin Luther King. They begin the project before the

What The Machines Do

Capture	Process	Publish
Camcorder*	Computer	Computer (diskette)
Tape Recorder*	Printer (paper)	
Computer*		Tape Recorder (audio cassette)
VCR (videotape)		

*The **Camcorder** captures images and sound. The **tape recorder** captures voices and sound. The **computer** captures text, numbers, and graphics.

multimedia center arrives in the classroom. They brainstorm their topic, do research in the library, develop an outline, and create a rough storyboard (a frame-by-frame visual outline that resembles a series of captioned comic book panels). When they have completed other assignments they use their free time to go to the school's computer lab to draw illustrated "pages" in their report using a paint program such as *Dazzle Draw* from Brøderbund Software or *Slide Shop* from Scholastic. They take the classroom's tape recorder around the school and interview teachers, and they visit members of the community who played a role in African Americans' struggle for civil rights. Then they write up their biography using the computer lab's word processing programs.

When the multimedia cart arrives in the classroom, the students take out a dubbing cable (see list of equipment above), and plug one end into the composite monitor jack in back of the computer (often marked with a picture of a computer monitor). They plug the other end of the cable into the back of the VCR in the hole labelled VIDEO IN. This simple connection lets the students "copy" their computer graphics screens directly from the computer to videotape.

Place a blank videotape in the VCR. To copy the first image a student presses "PLAY-RECORD" on the VCR. To pause the VCR between each image the student presses "PAUSE." While the VCR is in pause mode the student team loads another computer graphic image from disk. To unpause the VCR the student presses "PAUSE" again or "PLAY."

The Voices of History

As students copy their graphic images of Martin Luther King's life from the computer onto videotape, they read their report aloud into the Camcorder's microphone (the black, spongy knob that rests atop the camera's lens).

Students plug one end of the Camcorder's AV cable into the side of the Camcorder. The other end of the cable forks into two separate cables, labelled "VIDEO" and "AUDIO." At the end of each cable is a standard RCA phono connector (an "outie"). The VIDEO cable is left unconnected since the students' video source is the computer. The AUDIO cable is plugged into the AUDIO IN jack of the VCR. As the students narrate the words in their report, their spoken words are copied onto videotape along with the colorful image they have drawn on the computer.

The students use the magic of sound to make history really come alive. They alternate between reading their report aloud into the camera microphone and playing back the audio cassette with adults' "eyewitness" accounts of the civil rights era. The adults' names appear as a computer graphic on the screen as their voices are heard on tape.

Copying the adults' voices from audio tape to videotape couldn't be simpler. The easiest way is to press the "PLAY" button on the tape recorder and hold the speaker next to the Camcorder's microphone.

Test this approach with your equipment before creating your final videotape. If the sound quality isn't satisfactory, then you can achieve much higher quality with a M.A.G.I.C. cable and adapter. Take one of the RCA-to-RCA cables and plug either a 1/4" phone or 1/8" phone adapter onto one end (depending on the size of the "phones" jack on the tape recorder). Plug that end into the tape recorder. Plug the other end into the AUDIO IN jack of the VCR (after first taking out the Camcorder's AUDIO cable). Now you can press the "PLAY" button on the tape recorder and copy your audio-taped interview onto videotape to act as a sound track for the graphics image coming from the computer.

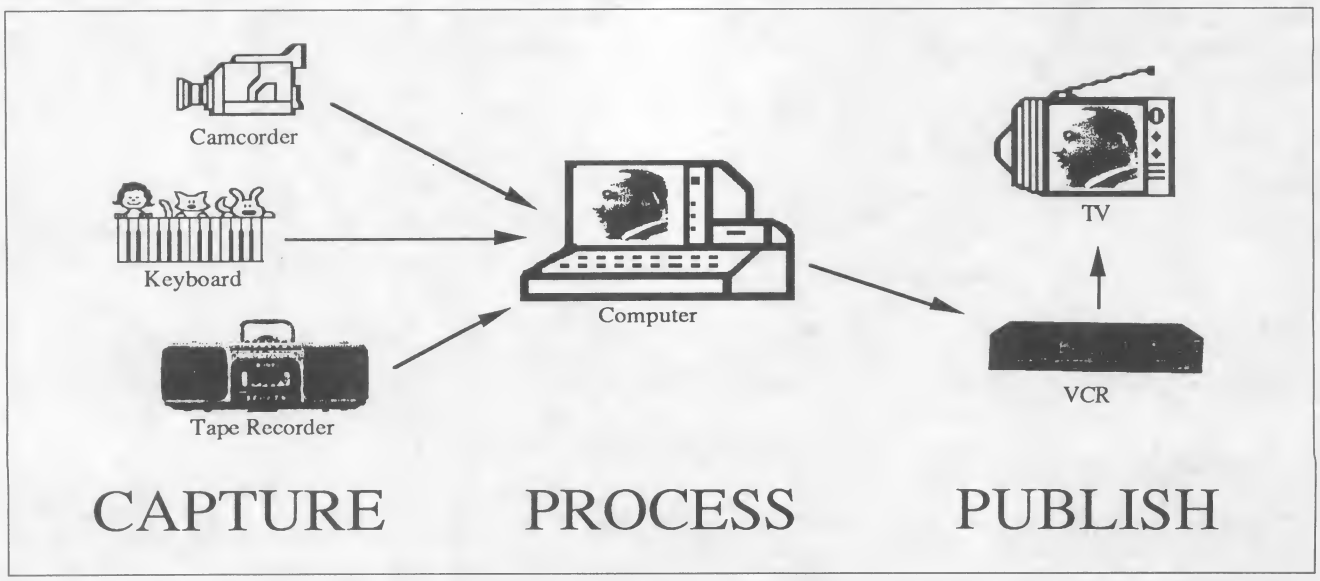
How can you tell if all this multimedia "M.A.G.I.C." is working? You look for the computer images to appear on the TV screen, and turn up the volume on the TV to hear your words and sounds. If you see a picture and hear sounds, then your center is working. If not, check your connections.

What makes the TV so special? Your multimedia center is a "daisy chain" of devices, beginning with the Camcorder and tape recorder and ending with the TV:

You capture the images, sounds, and text at the beginning of the daisy chain, process them through the computer, and publish them on a blank videotape in your VCR. The TV is the last device on the daisy chain. Since your VCR is hooked to your TV, the sounds and images that make it to your VCR will also make it to your TV. The TV is the ultimate test: if you see the images on the TV and hear the sounds, then you can be sure they are coming through your VCR.

The Sounds of History

To add even more drama to the oral re-



ports that your students are publishing on videotape, have them track down a recording of Martin Luther King's famous speeches such as the "I have a dream" speech. When the students wish to quote from a speech in their report they can press "PLAY" on the tape recorder and record the passage from the speech in Dr. King's own voice directly onto videotape.

Another dramatic touch is to add background noises as the students are delivering their report. These background noises might be crowd noises at a Civil Rights Rally, noises from a race riot, noises of busses, water fountains, marchers' slogans, chants, and songs. First your students need to find these noises on an audio cassette (or documentary videotape and copy them to audio cassette). They can play these noises on low volume near the Camcorder microphone as the students are delivering their report. The students' voices will magically merge with the crowd noises and create a stirring feeling that the students are delivering their report as history is being made.

Digitizing History's Noises

One last activity that students love is to digitize sound effects from history on a musical keyboard, then play back selected noises by pressing keys on the keyboard. Teachers can accomplish this by scavenging, borrowing, or buying a small musical keyboard manufactured by Casio—the *Casio SK-1,* or the slightly more expensive *SK-5*. Each of these keyboards is available for well under $100 at local electronics and department stores (and at Radio Shack where they are sold as the *Concertmate 500* and *Concertmate 650).*

The keyboards are fun to play with and simple to operate. When the students have found the noises from history that they would like to digitize, they place the speaker of the tape recorder next to the microphone on the SK-1 keyboard. They press "PLAY" on the tape recorder and press the orange "SAMPLE" key on the SK-1. This transfers the sound into the keyboard's computer memory. A moment later a "THUMP!" sound comes from the keyboard's speaker indicating that the keyboard has recorded the sound. You can copy the sounds directly from the tape recorder to the SK-1 keyboard by connecting one end of a M.A.G.I.C. cable to the "PHONES" jack of the tape recorder using a 1/4" or 1/8" adapter and the other end of the cable to the "LINE IN" jack of the SK-1 using an 1/8" adapter.

A student sits at the keyboard and plays any note on the keyboard to reproduce copies of the digitized sound. This technique is especially useful when the sound is just a small, momentary fragment of a larger event, such as a short phrase in a song, a shout, or an explosion.

Now the student can play the sound on the keyboard and reproduce the sound at will. He or she can also enrich the sound by playing up to four keys at a time. In this manner a single human voice can be turned into a throng! Each key reproduces the sound at a different pitch. The "A" above Middle C reproduces the sound at its original pitch. All other keys reproduce the sound at higher or lower pitches. This multi-pitch effect adds to the illusion that one voice has now become a multitude of voices.

Software to Get Started

There are dozens of programs that you can use in your multimedia center, including outlining programs, word processors, desktop publishing programs, paint programs, slide-show programs, and movie titling programs. You should experiment with software you already have on hand before you go out and buy any new software. However, eight programs that are especially useful are:

- *Slide Shop* from Scholastic, 730 Broadway, New York, NY 10003. (Apple IIe, IIGS, MS-DOS, Tandy)
- *VCR Companion* from Brøderbund, 17 Paul Dr., San Rafael, CA 94903. (Apple IIe, IIGS, MS-DOS, TANDY)
- *DAZZLE DRAW* FROM BRØDERBUND (APPLE IIE, IIGS)
- *Paintworks Plus* from Mediagenic, 3885 Bohannon Dr., Menlo Park, CA 94025. (Apple IIGS only)
- *Deluxe Paint II* from Electronic Arts, 2755 Campus Dr., San Mateo, CA 94403. (Apple IIGS, Amiga)
- *Splash!* from Spinnaker, 1 Kendall Square, Cambridge, MA 02139. (MS-DOS, Tandy)
- *KidWriter Gold* from Spinnaker (Apple IIe, IIGS, MS-DOS, Tandy)
- *Cartooners* from Electronic Arts (Apple IIGS only)

Each of these programs costs well under $100 and will provide you and your students with limitless opportunities to do multimedia publishing.

Now What?

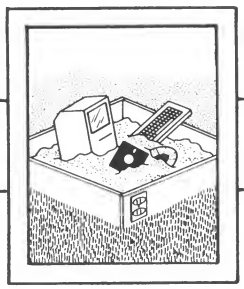
The "multimedia center" is a concept that has been successfully adopted by over sixty school districts around the U.S. and Canada. A "scavenged" workstation is a good first step for almost any school even if they are just beginning and even if they are trying to explore high tech using scarce resources.

Now it is time for us to look into ways to take your basic, scavenged workstation and gradually add new features and capabilities. In the coming months we will touch upon ways to improve your students' multimedia research and publishing through digitizing, video overlay, hypermedia, and telecommunications. The world of multimedia is wondrous and vast, and we've just taken our first step. Stay tuned.

Let Me Hear from You

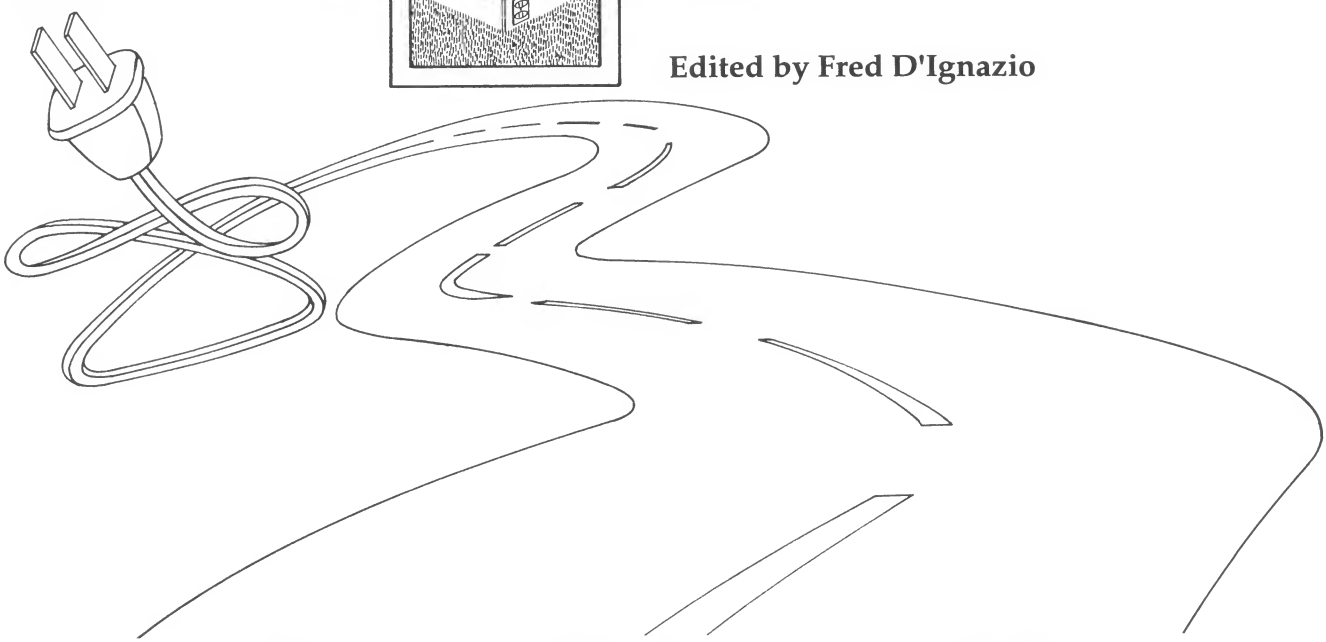
If you have been experimenting with any of the technologies covered in this column, please let me know. I would like to hear your eyewitness account from the multimedia trenches.

[Fred D'Ignazio, The Computing Teacher, 1302 Beech Street, East Lansing, MI 48823.]



Multimedia Sandbox

Edited by Fred D'Ignazio



Electronic Highways and the Classroom of the Future

In this column we've explored the concept of *desktop fusion.* All major knowledge, information, and communication industries are converging around the digital desktop computer. New, faster, more powerful microcomputers will soon have the ability to capture, process, store, and communicate all forms of knowledge—including words, still photos, video, speeches, hi-fi music, and animations.

Planetary Fusion

Desktop fusion resembles the process of planetary formation. Many scientists believe our planets were formed from motes of dust that combined into clods. The clods combined to form boulders, the boulders combined to form still larger boulders. The mega-boulders eventually combined to form planets.

Similarly, small electronic devices are starting to combine into more complex devices. Instead of the force of gravity (and centrifugal force) we have the power of the *integrated circuit* acting to draw different devices together. Microprocessors and memory chips have become the "souls" of all kinds of communication machines, such as telephones, TVs, fax machines, and CD-ROM drives. Now we see the machines themselves beginning to combine. Video cameras and VCRs have combined to form *camcorders.* TVs and VCRs are combining to form *TVCRs.* Boom boxes now commonly carry several "on-board" information appliances, including a radio, a cassette player/recorder, a compact disc player, and a TV. Sony recently announced the "Face to Face" picture phone, consisting of a tiny TV screen and a camera attached to a telephone. Casio makes a tiny musical keyboard, the *SK-1,* that has stored sounds from real instruments and voices, and a microphone and memory chip that allow you to digitally record and store additional sounds, including your students' voices.

In the process of planetary formation, small units combine to form bigger units. Due to the miniaturization of solid-state components and electrical motors, large, heavy units are combining to form smaller units. Sony's *Video Walkman* combines a color TV screen and an 8mm VCR into a TVCR the size of a paperback novel. The *10th Anniversary Walkman* includes a stereo radio and auto-reverse cassette player that you can slip into a shirt pocket. Transportable computers have become portables. Portables have become laptops. Laptops are turning into *notebook computers* and *memo pads.* And as they shrink, they are being combined with scanners, bar code readers, and faxmodems!

Tiny tech means more features, more devices fused together on a smaller piece of electronic real estate. And it usually means better quality. The Sony player may be the size of a box of crayons, but its *Mega Bass* delivers room-sized stereo sound!

Electronic Highways

All of society's information producers are busily converting their specialized knowledge into a digital format. In addition, they are furiously constructing new channels that have the speed, capacity, and reliability to rush their knowledge to its next destination. *These channels are the electronic highways of the 21st century:*

- Communication satellites
- Fiber optic lines
- Cable TV
- Microwave transmissions
- Cellular phones
- Computer modems
- Fax machines
- Broadcast television
- Radio

Who is building these highways? Who are the users? Businesses, government agencies, and higher-education institutions. Even drug lords, spies, and terrorists are on these highways. Everyone, in fact, is a builder or a user of electronic highways—except *schools!* With a few notable exceptions, K-12 schools are *not building, using, or planning to use* the electronic highways of tomorrow.

After all, what educational purpose do these highways serve? They carry news broadcasts, scientists' research findings, academic studies, government reports, banking and financial information, people's voices, data, and images. This may be the electronic buzz of an entire planet, but how does it fit into curriculum? And even if schools saw a way to incorporate it into a teacher's lessons, how would they *capture* it? How would they *transform* it into something useful in the classroom?

Electronic Dirt Roads

This attitude reflects the prevailing orthodoxy of how knowledge enters the classroom and how that knowledge is used. It has created an odd variant of the electronic highways that might be called the *electronic dirt roads*. Some pioneering schools are aware of the importance of electronic (increasingly digital) methods of capturing and communicating knowledge. Unfortunately, most of their efforts are in developing road systems that are walled off and insulated from the highways and byways of the larger world.

Many of today's current and planned distance-learning networks consist almost entirely of professors and teachers broadcasting their lectures to students in remote locations. In many cases, the students can respond to the teacher via a two-way audio link or a two-way video link.

The names *teleclassroom* and *distance learning* have the ring of "high tech," "innovation," and "the future." But we may be using electronic methods to reinforce a teaching environment better suited to the past.

Much of the educational research of the last decade has been critical of the "frontal lecture" method of teaching. New methods of learning are being developed as supplements and alternatives to the lecture style, including cooperative learning, apprenticeship, peer teaching and peer coaching, thematic learning, community problem-solving, and inter-generational learning. In classrooms of the future, today's educational leaders see students in active, problem-solving roles, working closely with their classmates to develop a "hands-on" understanding of curriculum topics.

In this context, is a distance-learning network that features an electronic "talking head" a road into the future—or a dead end? Few in business, government, or even higher education will wish to climb aboard and ride these roads alongside us. These K-12 networks may become electronic alleyways that have no role to play in the larger network of electronic highways that will carry almost all of the new knowledge of the 21st century.

A New Paradigm for "Classroom"

How does knowledge enter the classroom? What role does the teacher play in carrying that knowledge to the student? If the paradigm for a classroom shows knowledge entering the classroom through "teachers" and through "text books," then schools will try to extend that paradigm into the electronic age. Schools will create their own electronic networks. And the only travelers along those networks will be tele-teachers and tele-textbooks.

This model of the classroom has electronic trappings, but it doesn't turn the classroom into a *vehicle* that teachers *and* students can use to travel the *real* electronic highways in order to experience new knowledge for themselves.

It is 1990, and we are on the threshold of a new century. To prepare for the new century we need to create a new paradigm for "classroom." *In the 21st century a classroom won't be a stationary, isolated room, but a vehicle capable of traveling around the world, back into time, and out into the solar system and beyond.* The tools to turn today's classrooms from stationary boxes into sleek ships for knowledge exploration are already at hand. But we will never use them until we begin dreaming boldly and start imagining a new kind of "classroom" where we might teach.

Just in Time Training

In the classroom of the 19th century, the pace of emerging knowledge and the need for retraining was slow enough to permit a "trickle-down" method of dissemination. Educational publishers could take their time, digest the highlights of new discoveries, file them into appropriate subject headings and taxonomies, and distribute them as worksheets and textbooks to thousands of classrooms. Teachers played the role of "switch-

men" on the railroad. They routed these curricular materials, slotted them into the daily schedule of their school, and paced and measured their students' progress.

As we make the final jog to the next century, things are changing rapidly. New knowledge is exploding and growing more complex. The need for training and retraining is no longer occasional, it is constant. The whole notion of training is being redefined from an alternative track that a worker enters only once or twice a year to "on-demand" training and "just-in-time" training in which a worker receives training almost continuously, in order to cope with a constantly changing work environment. If the workplace changes from week to week, then a worker needs training in small, customized bites, right on the job, rather than on weeklong sabbaticals to special "training classrooms."

And what does the worker's workplace look like? It has real people. But there are also more and more machines whose job it is to take the worker to all the *virtual people* with whom he or she does business. Webster's dictionary defines "virtual" as not physically real but having the effect of being real. Computers, fax machines, telephones, and video monitors are becoming commonplace in the workplace. These machines are transforming the physical workplace into a *virtual workplace* that includes remote customers, suppliers, lenders, reference sources, and other business contacts that a worker interacts with on a daily basis. Work groups are not just the folks around you. *Virtual work groups* link workers in far-flung locations who communicate instantaneously in order to do business.

This is all made possible through desktop fusion. The computer hub and its constellation of electronic devices are becoming a vehicle that can carry workers to distant locations in order to transact their business. As corporations, government agencies, and higher-education institutions go through restructuring and modernization, they are equipping their workers with vehicles that can travel on small secondary roads and, increasingly, on the electronic highways of the wide, wide world. This is a lead that schools should follow.

The Old Paradigm for "Computer"

You are a computing teacher. Therefore you must use a computer. How do you see your computer? Most teachers see the computer as a kind of electronic Cuisinart. You pour information into the computer and—It slices. It dices. It blends. It whips. It purees.

And then it disgorges—onto its display screen, onto a noisy, buzzing printer, or into some peripheral device that blinks a hot red as its innards are flooded with computer output.

Teachers also see the computer as a device that stands still. It may be even bolted to the table that it rests on. Information travels through the computer, and people sit down and talk with the computer. But the computer stands still. It is stationary, fixed, and immobile.

A New Paradigm for "Computer"

The standalone, standstill computer is an old paradigm. This paradigm fits inside the old paradigm for "classroom," but it has less and less to do with the outside world. A new paradigm for "computer" is suddenly emerging. Associated with this paradigm are the concepts: *network, communication, connectivity, multimedia,* and *vehicle*.

We are, overnight, crossing the threshold from personal computing to *interpersonal computing*. In tomorrow's workplace, we will all be using *workstations* instead of mere computers. The word "workstation" implies *communication*. The workstation must talk with the other people and the other machines in the workplace, and it must talk with distant people and distant machines—down the hallway and around the world.

If we couple this concept of a communicating workstation with multimedia, we can see how the computer is no longer a stationary device, but a *vehicle*. Workers can ride that vehicle to a virtual workplace to communicate with their customers and colleagues. Students and teachers can ride that vehicle to the furthest reaches of human knowledge and imagination.

The Computer as Vehicle

In his award-winning novel *Neuromancer* (New York: Ace, 1984), science fiction writer William Gibson sees computers of the future as spaceships that carry hotshot pilots through *cyberspace*. "Cyberspace" is the invisible world of computer data. In the cyberspace of today, most of that data is at a primitive symbolic level, barely above the ones and zeros, on-and-off voltages that form the building blocks of digital code. But in the future, with desktop fusion, computers will transmit photographs, people's voices, movie clips, dazzling three-dimensional models, and animations that appear lifelike and realistic.

Cyberspace will be a virtual, electronic re-creation of the real world, with shocking richness, realism, and authenticity. Laserdisc and software authors face a formidable challenge in ensuring the accuracy and completeness of the sounds and images that will make up this virtual world. As on the recent magazine covers that placed Oprah Winfrey's head on Ann-Margaret's body, and digitally moved the Sphinx closer to its neighboring pyramids, the boundary line between the real world and the virtual will become increasingly transparent.

We are talking of nothing short of "instant electronic publishing." With the right tools from farsighted educational publishers, teachers and students can pilot their computer vehicles onto landing strips located in Prague, Czechoslovakia, underneath the Mediterranean Sea, atop the Galileo spacecraft orbiting Jupiter, or onto the small, bobbing boats that carried the American soldiers across the icy Delaware River during the Revolutionary War.

Sounds like a good PBS documentary?

It is far more.

At the helm of a multimedia computer,

students aren't looking at reality but at *virtual reality*. They can pause any event and instantly replay it. They can capture a video "window," resize it to a quarter of the display screen, and play a second video alongside it. Meanwhile, they can look up an encyclopedia reference and put it into a third window. They can make contact with a professor, policy maker, or architect, and, through multimedia Email, ask them to comment on the materials they are assembling. They can capture the first words of Nelson Mandela the moment he is released from prison, or the sounds of picks chipping away at the Berlin Wall, or the whoosh of helicopter blades as federal drug officials snare a drug runner just off the coast of South America. All these fragments of the real world can be cut and pasted into an interactive *virtual field trip* that the student team is assembling for their classmates, teacher, and local community.

A virtual field trip is an *immersion learning* experience. It reinforces and accelerates learning by placing learners in a rich, multilevel, real-world environment that they can experience with all their senses and that they can analyze using all the tools on the computer.

These tools are already available, and they soon will become inexpensive enough for any school. But they can only be used to their fullest potential if we rethink our notions of "computer" and "classroom." Schools must begin planning now to implement these new paradigms. After all, to travel the electronic highways of the future, students must first have a roadworthy vehicle. Such a machine must be able to communicate, and it must be able to process multimedia data (images, text, sounds, animations, etc.). It must be fast. It must be capable of high-volume (e.g., magnetic and optical) storage. But even with all these features, the machine is still just a box. It does not by itself create a classroom environment that allows teachers and students to use the computer to maximize learning and human development.

A Teacher Explorer Center

Two months ago this column described an inquiry-centered "classroom of the future." The classroom would run on multimedia "wheels" and be capable of carrying teachers and students anywhere they cared to go. It would be based on the new paradigm for "computer" and the new paradigm for "classroom" discussed in this month's column.

Such a classroom is now being created at East Lansing High School, just outside Michigan's state capital. The classroom is known as a "Teacher Explorer Center." It is a pilot training site for Governor Blanchard's "Classrooms of Tomorrow" program that is designed to put computers and other multimedia devices into the hands of more than 20,000 Michigan teachers over the next two years. We hope that many of the Classroom of Tomorrow teachers will come to the Explorer Center for training, along with government policy makers, business leaders, and representatives from higher education.

In the Teacher Explorer Center we are focusing on training teachers as *teacher explorers*—as knowledge navigators who can pilot their classrooms out onto the edge of human knowledge. Teacher explorers will make journeys to places, events, and especially to people. They will reach out and touch experts in the community, in the state, and around the world, and try to see critical areas of knowledge—math, science, geography, writing—through the experts' eyes, as pioneers on knowledge's frontiers and as "hands-on" practitioners who have knowledge not found in any textbook. Teachers will begin their journey by electronically linking up with experts in East Lansing, the nearby state capital, and local universities and community colleges.

Poles of Power

We are now scavenging resources in East Lansing to assemble multimedia "inquiry centers" for teams of teachers and students to use. We are hoping to set up five centers in the classroom: a teacher center and four student centers. Each center sits beside a *power pole*. We think of the power pole as the *entry ramp* onto the electronic highway. Physically, the power poles are simple aluminum poles—hollow shells. Inside the poles are wires and cables for electrical power, local area networking, video networking, cable TV, fiber optics, and telephone lines. Each cable represents a lane onto a different electronic highway.

The Starship Enterprise

Each of the five workstations can take its own entry ramp onto a different electronic highway. One team of explorers can go to Jupiter, another to ancient Rome, a third to the Amazon rain forest, a fourth to an archaeological dig in Asia, and a fifth on a whale watch in the North Atlantic. Each team goes on their journey as "mapmakers" armed with gear (camcorders, VCRs, still-image cameras, etc.) to capture bits and pieces of the real world so they can later analyze, organize, and re-create their journey for others to experience.

Teams are also encouraged to leave their workstation and make journeys to real places and interview real people in the local community.

Each journey is focused on important umbrella themes that organize the inquiry, give it a real-world context, and force the explorers to make decisions faced by real-world experts.

The explorer teams can journey separately, or they can journey together. Imagine the teacher as Captain Kirk on the bridge of the starship Enterprise. Around the teacher are teams of student explorers clustered together at their workstations. Together the teacher and students are on a mission to "boldly go where no one has gone before" —for example, to the future to calculate the effect of global warming on the earth's societies.

All the teams are mapmakers, playing a

supporting role in the classroom mission. One team, the math and science team, creates diagrams to analyze the effect of pollution on global warming. Another team, the Imaging team, gathers satellite images from NOAA, aerial photos, video clips, and magazine photos documenting the extent of temperature changes and worldwide pollution. A third team, the Journal Writers, supervises the first two teams and creates a written and verbal journal describing the class' journey. The fourth team journeys out onto electronic highways and contacts leading experts in the local community, a government agency, and a citizen's action group. They interview the experts and create miniature "expert systems" that simulate the experts' point of view, priorities, and key decisions.

At the end of the class' journey, the teacher has assembled a multimedia database and several problem-solving simulations related to global warming. The class is planning to present their findings as a virtual field trip to other classes and to their parents at the next Open House. They plan to publish their findings on the local public-access cable channel and by sending their findings to the experts they interviewed and to local news organizations.

A Multimedia Skateboard

The Teacher Explorer Center in East Lansing is a pilot classroom of the future that will serve the entire state of Michigan. Not every classroom needs to be this elaborate. The important thing is to begin thinking of your classroom as a room whose walls become "the world all around" (Maurice Sendak, *Where the Wild Things Are*, New York: Harper & Row, 1963). And think of your computer as a vehicle, not as a stationary box that processes data. If you can't afford a high-powered vehicle, don't despair. In fact, it's probably best to begin with something more like a skateboard. You can scavenge your multimedia from around the school. You can create a do-it-yourself version of desktop fusion by putting a camera, keyboard, computer, tape recorder, VCR, and TV together on one desktop. (See earlier "Multimedia Sandbox" columns in *The Computing Teacher* for details.) Next, find yourself a modem. Ask for a phone outlet into your classroom. Or try to get your principal to install cable TV.

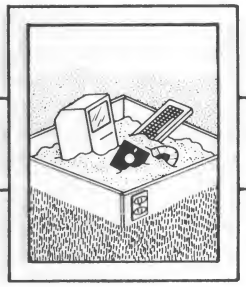
There are several levels of multimedia, each tailored to a certain size school budget. You can:

1. Set up a scavenged multimedia inquiry center in the library as a resource for the entire school.
2. Set up a rolling inquiry center that can visit different classrooms for different curriculum units.
3. Set up a shared inquiry center for two or three classrooms.
4. Set up an inquiry center in each classroom or in a single demonstration classroom.
5. Set up a multimedia "teacher explorer center" classroom with lots of workstations. Teachers and students can schedule visits to the center for special projects and "journeys."
6. Set up a cluster of multimedia inquiry centers in each classroom in the school.

Number one is the least expensive option; number six is the most expensive. However, as you can see, setting up a simple, scavenged inquiry center is affordable even for schools accustomed to operating on a shoestring.

It is time to rethink computers. It is time to rethink classrooms. Look to the year 2000 and create a long-range strategy for your classroom and your school. The year 2000 is still ten years away. You have a whole decade to make your dreams come true. The important thing is to begin.

[Fred D'Ignazio, Multi-Media Classrooms, 1302 Beech St., East Lansing, MI 48823.]



Multimedia Sandbox

Edited by Fred D'Ignazio

Restructuring Knowledge: Opportunities for Classroom Learning in the 1990s

By Fred D'Ignazio

Spaceman Spiff

My favorite *Calvin and Hobbes* strip is one that I pulled off the calendar in our kitchen at home. The strip shows Calvin as Spaceman Spiff, blasting around the galaxy, discovering a new dimension where time has no meaning. In most of the strip Spiff is in control. He is heroic. He is making life or death decisions. However, in the last panel, Calvin is no longer the spectacular Spiff. He is just a kid sitting at his desk at school. "Off camera" we hear his teacher saying, "Now we carry the one into the tens column... "

When I was young I was a "Spaceman Spiff." Now I am the father of an eleven-year-old Spaceman Spiff. In fact, we are raising a whole generation of Spaceman Spiffs. Their egos and imaginations are fed a steady fantasy diet of MTV, one-second video and sound bites, Ninja Turtles, Wrestlemania, Stephen King, Nintendo, high-powered commercials, and jazzed-up movies with computer-synthesized special effects and digital, high-fidelity surround sound.

It's a sea of electronic media out there. And our kids are submerged in the sea with their eyes, ears, minds, hearts, and imaginations wide open, swimming through the media, devouring the media, seeing themselves reflected in the media.

And then the school bell rings.

Our children scramble into school and leave the outside world behind. They close the classroom door, and the turbulent sea of images, rotating text, voices, music, and sounds disappears. The tide recedes. The sea dries up. And in its place is a tiny trickle of numbers and words—a spoken stream flowing from the mouth of the teacher and a printed stream slowly scanned on a page in a textbook.

How do kids react to being yanked from the sea, hauled from their habitat, beached like a whale on an arid shore?

Who you gonna call? Spaceman Spiff!

The Multimedia Pencil

Clearly we have a problem here. Teachers have important things to teach their students—language skills, computational skills, science, history, culture, civilization. We can't have our students tripping out just when we serve up a carefully crafted meal selected from each of the basic educational food groups.

Fortunately, help is near. In the past 10 years something new has come into the world: *tiny tech*—a blizzard of tiny, portable computers, video cameras, VCRs, cellular phones, fax machines, musical keyboards, Walkmen, and other miniature gadgets. We have mistaken most of these devices for toys, but they are not really toys at all. Instead they are multimedia pencils—harbingers of a new era in human history, an era of interactive, multi-sensory, restructured knowledge.

In past eras, what were the carriers of knowledge? The human mind, the mouth, spoken language, written language. In the world of the past, the power tools of knowledge were the pencil and the pen.

Now new pencils and pens are emerging. Video cameras, for example, are visual and auditory pens, capable of capturing real-world images and sounds from a child's own world—the real stuff of life as kids live it. New camcorders like Sony's TR5 weigh only a few ounces and fit into a kindergartner's hand. Camcorders will soon be small enough, simple enough, portable enough, and cheap enough to become children's personal thinking tools, the carriers of what children feel, think, and observe about the world around them.

Post-Desktop Fusion

There is something else out there, too. It's more than a sea of media or a blizzard of tiny tech. It's a process of rapid, accelerating confluence and convergence. All those tiny devices—the cameras, TVs, faxes, and so forth—are coming together and fusing. They are becoming something beyond computers, beyond TV, beyond telephones, beyond copying machines and other appliances that have become mundane fixtures of the adult workplace.

We are witnessing *post-desktop fusion*. It is "fusion" because computers, cameras, and other knowledge appliances are transforming themselves, combining functions, and growing smaller and smaller. The process is so quick that we can almost see it with the naked eye. It is "post-desktop" because we are swiftly moving beyond the desktop as a metaphor and as a hub for capturing, processing, and communicating knowledge.

We used to talk about "desktop computing" to reflect the fact that computers were small enough to fit on everyone's desktop. But computers have continued to shrink to post-desktop sizes—from transportable to portable, from portable to laptop, from laptop to notebook. Now we have pocket computers. And talking, wrist-top computers with built-in speech recognition and cellular faxmodems are not far away.

Dick Tracy, here we come!

The term "desktop computing" is also troublesome from the computing point of view. In a world in which microchips have burrowed their way into every appliance to make it "intelligent" and "programmable," where is the real computer? It may be the video computer that we use to capture images and sounds and that we call a "camcorder." Perhaps it is the "smart TV" or "programmable telephone" or the battery-powered portable fax copier. One thing is certain—computers are not just boxes resting on desktops. Instead they are more like caterpillars busily transforming into butterflies of startling shapes and sizes. And herein lies our opportunity for restructuring knowledge—to expand knowledge beyond a narrow stream of text and talk to a rich flood of multimedia knowledge that feeds the senses, stirs the imagination, and pierces the heart. Learners are not just little linear text computers. They are human beings with bodies, senses, and sensitivities that yearn to be tapped. It is time that we feed and nurture human beings as whole persons and let them communicate in a multitude of modalities.

Do Trash Cans Turn You On?

Where are the fresh metaphors to inspire us and help us understand a world of interactive, multi-sensory, restructured knowledge? Is the textbook an appropriate metaphor? The blackboard? The desktop?

Be honest. How appealing is the desktop for the average human being—adult or child? Do little images of trash cans and file folders really turn you on? Do they capture the power of creating interactive presentations that begin to have the "look and feel" of the real world?

Do they reflect the way "knowledge" will be captured, constructed, and transformed in the workplace of the future? The "desktop" is appropriate if your pen is made of wood and lead and you need a flat, horizontal writing surface to become an author. It is less appropriate if you can become an author with a little mobile *fusion pencil* that includes a stylus and a screen on which to write, that runs on batteries, that has a built-in video camera (or jack), a microphone, a cellular faxmodem, and stereo speakers. You can hang your "pencil" from your shoulder or pop it into your knapsack. You can take it to conduct multimedia interviews with senior citizens who actually lived through the Great Depression or the First World War; with scientists at a local college or business; city officials who are struggling with where to locate a new prison, how to dispose of solid waste, or how to preserve the habitat of an endangered animal.

You can "write" using your fusion pencil while you are at a friend's home, on the playground, on a bus, at the kitchen table, or under a tree. In a world of fusion pencils, the desktop is *the world*, and your job as a young multimedia author is to go out and capture bits and pieces of that world to share, describe, and make understandable to those around you.

Scavenging in a Gutenberg-Plus World

Using a fusion pencil, all those Spaceman Spiffs out there can put "pen to paper" and create dazzling, animated graphics, moving images, and high-fidelity sounds. They can create miniature models of the real world that come to life through the shrewd use of sounds, images, and words that engage the imagination.

They can become authors in media they now only consume.

Teachers who recognize the power of these new multimedia pencils are smart. Their students can explore restructured knowledge and do multimedia publishing—in the classroom and on a shoestring. For example, a savvy teacher can build a scavenged publishing center for her students out of the flotsam and jetsam of scuffed-up devices that kick around every school (the record players, tape players, VCRs, TVs, computers, and cameras). Teachers can be on the cutting edge by repurposing low-cost equipment they already have and by combining it into a multimedia publishing center that simulates fusion pencils of the future.

These centers tap young people's vast, latent, hidden skills in an emerging world of restructured knowledge. Children have acquired enormous navigational "literacy" skills from a lifetime of swimming through a sea of electronic multimedia. Children already know how to "read" this media. Now let's teach them how to "write" it.

And not stop there.

If a teacher is going to help her students restructure knowledge she first must ask herself: What is knowledge? If knowledge is text, then students can use word processors, animation programs, CD-ROM, and online databases to capture knowledge, organize it, and create publications. If knowledge is images, then students can capture, explore, manage, and manipulate knowledge with video cameras, laserdiscs, computer graphics, and so forth. If knowledge is sounds, then students can capture sounds with microphones, digitize sounds into the computer, and explore sounds on a tape player, Walkman, or record player. If knowledge is people's spoken words, then students can tape their own words and the stirring words of famous individuals such as Thomas Edison, Martin Luther King, Jr., and Helen Keller.

If we redefine "knowledge" as being something more than spo-

ken and written text, we move to a new definition of knowledge—not a post-Gutenberg definition but a *Gutenberg Plus* definition of knowledge. The Gutenberg Plus definition retains the high regard for written and spoken language as a tool of thought, communication, and imagination. But it also values young people's significant skills in visual and auditory literacy, in manipulating complex visual, textual, auditory, and three-dimensional models (computer games), and their experimental attitude toward mastering and troubleshooting complex multimedia equipment.

Experiments vs. Productions

Smart teachers should value these skills and assign responsibilities to students to help guide them and harness their skills to explore knowledge in new ways that would be too rich and multi-faceted for a teacher to attempt on his or her own.

Smart teachers should not feel inadequate if their students' technical skills far exceed their own. They should not feel intimidated if their students' work surpasses their work.

What type of work should students do? Not *productions*. Teachers should avoid multimedia productions like the plague.

"Production" is a word from the past—from the era of Hollywood, Madison Avenue, and Broadway. It is a term describing one-way media that is produced by producers and consumed by everyone else. A production is linear, often passive, and incapable of being altered, annotated, or repurposed by the user. A production makes someone the "producer" and everyone else the "audience."

Productions themselves can be pits. They are costly, time-consuming, and require special expertise. Productions are not practical for daily classroom learning. They are also not appropriate for the coming era of personal, interactive, restructured knowledge.

What is appropriate? How about knowledge experiments, "how-to" demonstrations, rapid prototypes, instant publishing, and throw-away multimedia databases. Students' multimedia research and publishing must be cheap, quick, dirty, and out the door to meet students' and teachers' needs. It must be conversational—students and teachers must feel free to invent, experiment, draft, test, and reshape the media on the fly.

Classroom publishing centers should not be little TV studios and publishing houses. These are models of the old media. Instead they should be messy innovation labs, inquiry centers, and impromptu spaceships that take students and teachers on low-budget, half-hour electronic field trips to explore knowledge spatially and contextually—just as it exists in the real world.

Share-A-Student

Webster defines the word "virtual" as "having the effect of being real without physically being real." Students are already part of a *virtual world* created through the old, one-way electronic media. This is the cultural "sea" that they swim through outside the classroom. However, teachers and students can also create their own virtual worlds using the new interactive media.

A *virtual classroom* in the future will have the look and feel of the real world. With the addition of low-cost telecommunication devices (faxmodems, two-way cable TV, etc.), students in physical classrooms will be able to collaborate and form virtual classrooms that span cities, states, and countries. Students will be able to participate in virtual "share-a-student," "junior-year abroad," and "foreign-exchange" programs electronically rather than physically. Teachers will help students reach out to scientists, policy makers, business leaders, writers, and artists and invite them into the classroom as virtual guests, virtual teachers, and virtual "writers in residence" for a day, a week, or a semester.

The mark of a real virtual classroom of the future is how thoroughly it engages in *local-global fusion*—the integration of the real world right outside the classroom door with events of global significance and universal impact. It is not enough just to study "the world" if that world is remote and the people in it are people you could never hope to meet yourself. Nor is it enough to study only the nearby physical world that students experience with their own senses. With the help of telecommunications and portable "fusion pencils" students can explore both worlds simultaneously to create a balanced picture that demonstrates the fragile, interlocking nature of all actions, events, and people's lives on our planet.

Memorization vs. Models in a Virtual World

In the classroom of the future, students will be able to assemble multimedia databases on their computers that have a startling, lifelike quality. The databases will have fragments of the real world: its sounds, its voices, its music, its images, its spoken and written languages—its exceedingly rich, profoundly important texture. The proof of the success of the databases will be how well they mimic and recreate reality and, equally, how well they help student authors and their classmates explain, describe, and understand the real world.

When they are successful, multimedia databases can become something more than "databases." Perhaps we need a new term to describe them. Perhaps "knowledge bases," "meaning bases," or "reality bases" is more apt.

Or how about *virtual reality*?

In the classroom of the future, students will move away from memorization of facts and become authors skilled at crafting models of the real world. These little virtual-reality databases will have the look and feel of the real world, but they will be computer based simulations that can be paused, replayed, and analyzed from a dozen different perspectives (mathematical, spatial, historical, geographical, contextual, etc.).

You might call them multimedia story problems in which students focus on the dilemmas of real people—moms, dads, scientists, explorers, and quarry foremen—as they confront life and try to make timely decisions despite too little information, too little time, and a chaos of competing distractions and alternatives.

These story problems can become the interactive presentations that students create for their classmates and challenge their classmates to solve—with the aid of the multimedia databases for research, experimentation, "what-if" speculation, and "just-in-time training."

What Does a Cab Driver Know?

The ultimate goal is for students and teachers to build their own expert systems out of multimedia databases and multimedia story problems that focus on real-world expertise, the problems real people confront, and the decisions they must make. These systems let students simulate a real decision maker operating in the real world. For example, if students were to "model" a taxi cab driver in a large metropolitan city (or their own home town!), they would start by scanning maps of the city into their computer. They would research documents and interview people in the local public roads department. They would also enlist their older friends and their parents to drive them around town while they videotaped the major arteries, intersections, and highways that crisscross the area. Last, they would interview real taxi cab drivers and listen to the way they navigated the city, paying attention to their special knowledge regarding daily traffic patterns, roads under construction, alleyways and hidden shortcuts too new or too obscure to appear on any map. Students would build all these items into a multimedia database and multimedia story problems that focused on real highway planners, real commuters, real policymakers, and real cab drivers.

But they wouldn't stop there.

Through the process of presentation, publication, and interactive class discussion, the student cab-driver team would evolve its database/story problems into a working expert system that reflected printed, analytical knowledge and knowledge that never finds its way into any textbook or any document—knowledge "mined" from the experience and practical savvy of real-world people as they go about their jobs.

The result? A real-world, multimedia expert system created entirely by students and their teacher. Such a system would be worthy of a public forum—presented over local cable or two-way interactive TV; "telepublished" via modem; or delivered live to the city council, government planners, and city officials.

Such a system would be a non-trivial task for students and teachers to dedicate themselves to. Instead of working with warmed-over knowledge and hand-me-down tools to solve toy problems, students would be immersed in the complex stuff of reality. As Judah Schwartz of Harvard says, "In the classroom of the future, knowledge will not only be transmitted, it will be *created*."

This is the type of classroom our students and teachers deserve.

This type of classroom will give every student and teacher the chance to become a Spaceman Spiff. Even better, the world they navigate and the problems they solve will not be the stuff of fantasy or dreams, but the real world seen from a thrilling variety of rich perspectives.

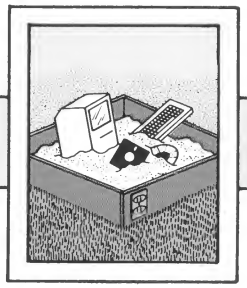
The challenge will be supreme. In fact, it is just the ticket we need to engage our young people in classroom learning in the 1990s. Anything less and we can be sure that part of their minds, hearts, and imaginations will soar right out the window, off to a galaxy far, far away, and we will let a precious opportunity slip through our hands.

The Teacher Explorer Center

The Michigan Department of Education has awarded a grant to East Lansing Public Schools to set up a model "classroom of tomorrow" that demonstrates the ideas above. The name of the classroom is the *Teacher Explorer Center*. The center will demonstrate how teachers can use new, integrated technologies to restructure knowledge and implement new strategies for classroom learning.

The center will host demonstrations and full-day workshops for teachers, policy makers, and community leaders, beginning in late May and ending in September. To learn more about these demonstrations and workshops, please call the Teacher Explorer Center at 517/337-1781 (ext. 58) or write Teacher Explorer Center, East Lansing Public Schools, 509 Burcham Drive, East Lansing, MI 48823.

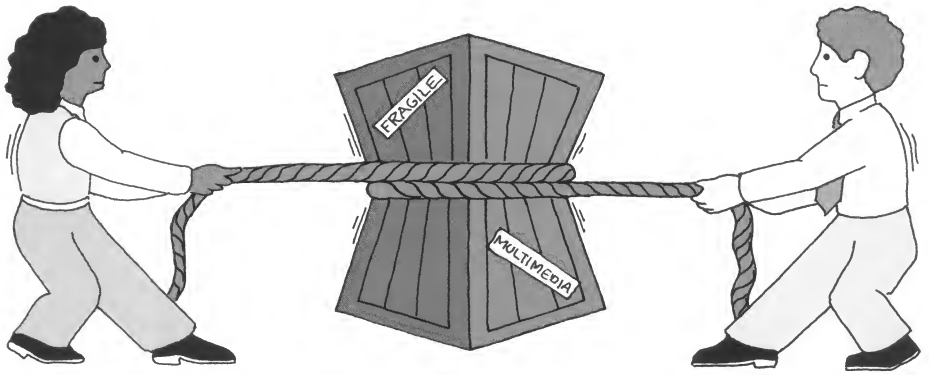
[Fred D'Ignazio, 1302 Beech St., East Lansing, MI 48823.]



Multimedia Sandbox

Multimedia Horsepower: How Much Is Enough?

By
Fred D'Ignazio



In last month's column we looked at an inquiry-centered classroom of the future that combined advanced teaching and learning strategies with multimedia computing. This month we'll look at the kind of workstation you'll need to create that classroom.

Multimedia Tug of War

Multimedia is a new field. In fact, it's so new, it's not even here yet.

It *is* true that diverse industries (publishing, telecommunications, computing, etc.) are converging around a digital, electronic standard. But this is a gigantic, lengthy progression that will not be completed until sometime in the next century. In the meantime, we have industries that are *almost converged*, and in between these industries (and a single box that does it all) lurk scores of spaghetti-like cables and adapters, devices that refuse to be mated, and "black holes"—pits of befuddlement and panicky discomfort—that await those of us who are trying to jumpstart a jury-rigged technology.

Furthermore, it's not even settled just what multimedia is, what kinds of equipment you need to do multimedia on, and how you do multimedia in the first place.

Is multimedia desktop video? Is it desktop presentations? Is it HyperCard/Laserdisc? Or Linkway/DVI? How many display screens do you need? Is it *kosher* to capture with your own camera? Can *de rigueur multimedia* be anything but digital? (For example, a VCR is not digital; neither is a Califone record player, a Walkman, or a boom box. But many schools are doing amazing "multimedia publishing" on these non-digital devices.)

Don't you sense the rise of a *multimedia chic?* Be honest: Is it socially respectable to do multimedia on anything less than a megabyte of RAM and a 20-megabyte hard disk drive?

If you go guru-hunting and latch on to a couple of multimedia trendsetters in your school district, you are likely to go away confused. If you talk to two or more "early adopters" of multimedia you may discover a profound tension created from differing points of view. Right now people do not agree on the basic nature of multimedia and what it takes to get started.

This tension is created by a "tug of war" between *multimedia futurists* and *multimedia pragmatists*. A multimedia futurist is hooked on the grand potential of multimedia. He establishes a high threshold for where multimedia begins. This threshold is so high it stretches the limits of today's technology—and the average school's budget.

At the other end of the tug of war is the multimedia pragmatist. The pragmatist is firmly grounded in the present. She is just as impressed with the potential of multimedia, but she understands that it could take years to assemble the kind of multimedia

workstation advocated by the futurist. This delay drastically postpones most teachers' hands-on experience using multimedia. Perhaps, says the pragmatist, there is a lower threshold for multimedia. Perhaps we can scrape, scavenge, and scrounge, and come up with equipment from around the school that will get us started *now*.

(By the way, the multimedia pragmatist's approach sends the multimedia futurist—and the hardware vendors—into multimedia apoplexy.)

A Road Map for the 1990s

It is 1990. Just looking at that date brings out the strategic thinker that dwells in all of us. After all, in just ten years—in *exactly* ten years—it will be the year 2000. The Class of 2000 is already midway through the second grade!

This is a good year to create a long-range plan, a plan that incorporates your district's (or your building's) long-range technology objectives *and* instructional objectives. One nice thing about doing a 10-year plan in 1990 is that you can put the year "2000" on the cover of the plan. (This looks pretty sexy and makes you look visionary.)

Another nice thing is that by creating a multi-year plan you take the pressure off to do everything *today*. This is a wonderful relief—especially when it comes to multimedia. The budgetary savings alone is worth the effort of developing a plan. For example, a high-end multimedia system can cost anywhere from $10,000 (for a single multimedia workstation—see the *tec 2000* workstation specs below) to $120,000 (for a multimedia ILS lab with networked workstations, CD-ROM, headphones, talking computers, a lab technician, etc.) On the other hand, a scavenged multimedia workstation can be assembled around your school's existing computer, video camera, VCR, TV, and the purchase of circuit cards and software for under $500. (See the *tec 1990* workstation specs below.)

One Computer For Every Kid?

It is time to begin questioning the popular wisdom (Seymour Papert, can you hear me?) that says that the target we are shooting for is "one computer for every student." Maybe this is a desirable thing and maybe not. Either way, for most school systems a 1:1 student-to-computer ratio is still a long way off.

Instead of fixing our sights on a single (and, perhaps, unrealistic) target, perhaps what we really need is a variety of configurations to create a well-rounded instructional environment. Depending on a teacher's style, a one-computer classroom might be a reasonable near-term goal. In other classrooms, three or four student workstations and a teacher workstation might be the appropriate configuration.

The new research into cooperative learning, thinking skills, apprenticeship, and peer coaching suggests very strongly that students should spend much of their time learning in teams and collaborative groups. When they graduate from school and enter the workforce, their ability to work and communicate well with others will be at least as valuable a skill as computer literacy.

Perhaps we should plan computer environments that combine computer literacy with collaborative learning. This will reduce the pressure to keep adding computers and force us to think of new, creative configurations that suit each teacher's classroom.

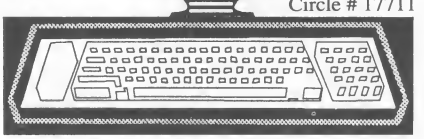
Multimedia demands this kind of fresh thinking. It is far too costly to buy a multimedia workstation for *every* student. Instead schools might begin planning two kinds of *shared* multimedia workstations for their classrooms of the 1990s: a low-end, scavenged "center" that can be used by five-member student teams and a high-end "studio" that rolls around the school.

A school can afford lots of low-end multimedia centers, but it can afford only one or two high-end studios. This is not necessarily bad. You can get the biggest "bang for your buck" on a low-end center. These centers can be placed in classrooms around the school and can help teachers bring the curriculum to life for their students. And the high-end studio can be placed on a low, wheeled cart and shared among all classrooms as a school-wide resource. You can think of one of these high-end "LinkCarts" or "HyperCarts" as a mobile video studio, audio studio, publishing center, and teleclassroom, all rolled into one. Teachers and students can borrow the cart to create group presentations on important curricular themes. The results can be shown in the school auditorium, to the PTA, to the school board, or to local businesses. Principals can use these studios to create snazzy multimedia presentations that show off all the good things that are going on in their school.

A Two-Pronged Strategy

The best way to resolve the multimedia tug of war between the futurists and the pragmatists is to create a two-pronged strategy for multimedia. Prong #1: You assemble several scavenged, low-end multimedia workstations for immediate use in your classrooms; and Prong #2: You budget for one or two high-end systems that can be used by your entire school.

Below are two configurations for you to consider: a high-end system called a *tec 2000* (a *teacher explorer center* that anticipates the technology of the year 2000) and a low-end system called a *tec 1990* (*teacher explorer center* using the technology of today). The concept of "teacher explorers" comes from our last "Multimedia Sandbox" column. In that column we talked about multimedia workstations (high-end *and* low-end) that can be vehicles of exploration for students and teachers. Student and teacher explorers can use a multimedia inquiry center to transform the driest, most abstract subjects in their textbooks into exciting, colorful, animated presentations. Student teams can "pilot" their multimedia vehicles on *electronic field trips* into the past, around the world, and into outer space.



The *tec* Workstation

Just what *is* a tec workstation?

The *tec* (teacher explorer center) workstation is a prototype workstation of the future. During the 1990s, audio, video, telecommunications, publishing, and performing-arts technologies will converge around the desktop computer. This "desktop fusion" will produce a single box—a *multimedia computer*—capable of capturing, storing, and publishing multimedia documents composed of human voices, moving images, photographs, and three-dimensional mathematical models, as well as numbers and words. The multimedia computer of the future will no longer be an isolated workstation, but a *vehicle* capable of travelling the electronic highways that will carry the new knowledge generated by international news organizations, universities, businesses, and government agencies.

A *tec 2000* workstation must have large amounts of online (RAM, hard disk, and optical) memory and be exceptionally fast, or it will be overwhelmed by the flood of data generated by moving images, sounds, animations, and large multimedia databases of all sorts.

A high-end desktop computer acts as the hub of a *tec 2000* workstation. Among the "hub" computers you might consider are the Macintosh IIci, IBM PS/2 Model 70 or Model 80, the Commodore Amiga 2000HD, and workstation computers from Sun, NeXT, and Hewlett-Packard.

Above is the high road into the future. Below is the low road: *multimedia for the rest of us!*

The *tec 1990* workstation is a low-cost alternative to the *tec 2000* workstation. The *tec 1990* workstation has a common classroom computer as its hub (e.g., an Apple IIe, IIGS, Commodore 128, or low-end MS-DOS computer). Schools can scavenge additional equipment as multimedia peripherals to the computer.

What do a *tec 1990* and *tec 2000* workstation look like? Below are two generic configurations.

The *tec 1990* Workstation

Computer

Apple IIe, Apple IIGS, Commodore 128, or low-end MS-DOS computer
128K - 1 Mb of RAM
Two 3.5" disk drives (or one 5.25" drive and one 3.5" drive)
Color Monitor
Keyboard
Mouse
Necessary Cables
Related manuals
ImageWriter II, Proprinter, or equivalent
Video overlay card
Digitizer card
Sound sampling card
Paint, Publishing, Music, Video, HyperMedia Software
1200-baud or 2400-baud modem
Network card, software

Multimedia Peripherals

Camcorder
VCR
Boom Box
TV
Laserdisc player

The *tec 2000* Workstation

Computer

CPU: 68030, 80386, or higher
Hard disk with removable 45 Mb cartridges (or 160 Mb of storage or greater)
Two high-density (>1 Mb) external disk drives
High-resolution, multisynch, grayscale and RGB color monitor
Mouse, keyboard, cables
9600-baud modem *and* 9600-baud fax modem
Operating System software, manuals
80 Mb tape backup hardware, software
Networking hardware, software, cables (network server?)
Laser printer, cables, software
Multimedia capturing, publishing, and presentation software

Digitizing Equipment

256-grayscale or color scanner, software
1/30-second frame grabber (color or B&W), software
Audio sampling/digitizing hardware, software

Optical Equipment

CD-ROM and/or DVI drive, cables, software
Laserdisc player, cables, software
LCD card, cable, panel to use with overhead projector (to project large-scale image of computer screen)
Overhead Projector (suitable for use with LCD panel)

Video Equipment

Genlock, video overlay, special-effects circuit cards for computer
Software, cables to enable computer to control video devices
(including VCRs, laserdisc players, still-image cameras)
HI-8 Video camcorder—with remote jack to connect to computer
HI-8 VCR—with audio dub, PIP, remote jack to connect to computer
Still-image camera/player—with remote jack to connect to computer
Small color monitor—for editing, camera work
Large color monitor for presentations—with remote jack to connect to computer
Two Picture Phones (e.g., Sony "Face to Face") for transmission of video still images
Portable video projector (e.g., Kodak LC-500, Sharp XA-100)
Portable screen (2) suitable for LCD and video projection

Audio Equipment

Two high-quality amplified speakers (e.g., Bose, Acoustic Research)
MIDI Sampling keyboard, MIDI cables, MIDI software

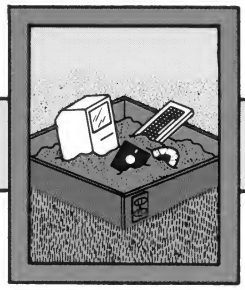
Next Month

Next month we will look at another controversy swirling around multimedia: How can teachers best tap the potential of multimedia: As programmed, computer-assisted (multimedia) instruction? As an electronic (multimedia) textbook? Or as an inquiry center that supports collaborative research, investigation, publishing, and presentation?

The basic question is one of demand: Do you as a classroom teacher prefer your multimedia prefabricated, structured, clearly labelled, and in bite-sized chunks? Or do you prefer a multimedia center for students to capture, organize, and process bits and pieces of the real world? Preprocessed multimedia is simpler, is packaged to look like older, educational materials, and leads to predictable outcomes. Open-ended, student-collected multimedia (in the form of photos, interviews, videotapes, student artwork, etc.) is open-ended, often messy, and leads to unpredictable outcomes.

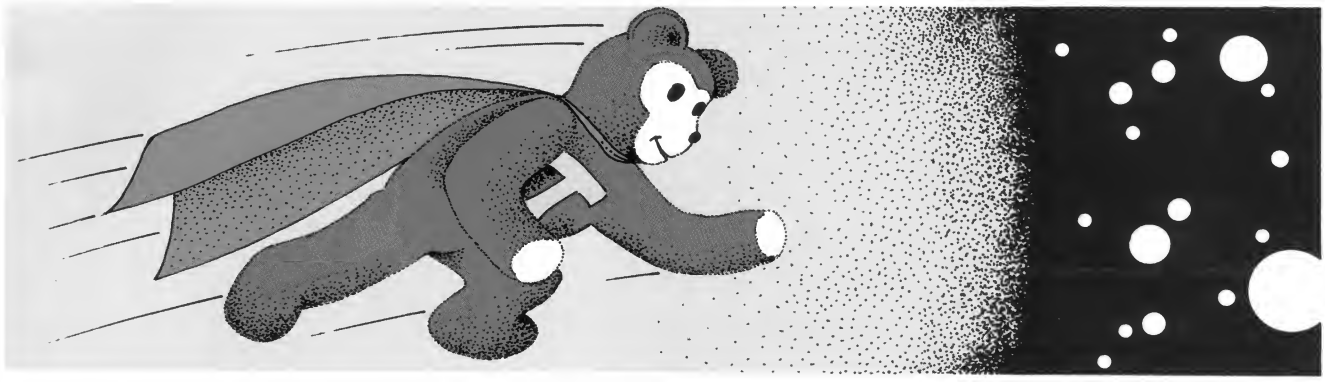
Which kind of multimedia do you prefer? Which kind of teacher are you? Stay tuned.

[Fred D'Ignazio, Multi-Media Classrooms, Inc., 1302 Beech St., East Lansing, MI 48823.]



Multimedia Sandbox

Fred D'Ignazio



The Search for "Teddy's Dream"

I am the director of the Teacher Explorer Center, a model multimedia classroom of the future for the state of Michigan. Every day we train 25 teachers and administrators in advanced multimedia tools and new teaching strategies such as cooperative learning, critical and creative thinking, and classroom publishing.

Every day at five, after all the workshop participants have departed, our family's nanny, Carole Trumbell, drops by the center to bring me my 17-month-old daughter Laura. As soon as Laura arrives, the first thing she says is, "Bear!" "Bear" is the flying teddy bear who is the hero of a brief computer animation entitled "Teddy's Dream," a selection on The Voyager Company's *Dream Machine* (vol. 2) laserdisc. Laura gets to see "bear" flying every day when Carole drops her off at the end of my workshop.

Since this is a daily ritual, it would seem that I would be able to pop a laserdisc on the Sony laserdisc player and quickly find the bear. *This is something I wish I could do.* Laura is not as patient as the educators who visit our center. If "bear" does not immediately appear when she calls him, Laura takes off, patrolling around the center, crawling under the workstations, climbing onto chairs, dragging mice to the floor, pushing VCR buttons, signing onto the computer network, and using CD-ROMs as stepping stones for a game she has invented called "Hop-Hop!"

With one wary eye on Laura, I frantically search our laserdisc library for the "bear" disc. When I find it I turn on the laser player, pop in the disc, turn on the TV monitor, and, voila! ... a blank screen. Uh-oh! That means the laser player is no longer routed through the VCR. I run around the workstation to check the cables. I find Laura on the other side, head propped underneath a camcorder tripod. "Hat!" Laura giggles as she picks up the camera and tripod and marches across the room with a $1,500 "hat" on her head. Cables strain. Expensive boxes on the workstation table begin to slide ominously close to the table's edge.

I capture Laura, take off her "hat," and quickly recable the back of the laserdisc and VCR. I turn on the monitor for the computer that is going to control the laserdisc, and find that the computer, too, is switched off. I groan. This means five minutes of booting up the computer and logging it onto the network. At the same time I also notice that the computer is not plugged into the video adapter that will allow me to project its image onto the big TV monitor at the front of the classroom.

I shake my head in despair. Laura will be disappointed. She is presently crawling up my left leg, chanting "Bear! Bear! Bear!" The reason for this enthusiasm, I'm sure, is that she is used to seeing "Teddy's Dream" on the big 41" Sony projection monitor, hearing the sound track in digital surround sound, and, while the room is dark, having her daddy lift her up and fly her around the room just as, on the video screen, Teddy goes flying through outer space.

"No compromises," I mutter.

Ten minutes later, I am rushing around the room carrying Laura under my left arm and balancing three remote control devices in my right hand. "Bear" is now up on the big screen. This is, in fact, the seventh time he has appeared—all of them minus the dramatic music that usually accompanies his flight. Why is there no sound?

I stab at half a dozen buttons on the remotes. I crouch down near to the floor and check the amplifier. Is the right setting "Dolby—Concert Hall" or "Simulated—Outer Space?" Is the VCR supposed to be set to "L1" or "L2?" What are those mysterious black cables doing next to the monitor?

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The Search for "Teddy's Dream"

continued from page 16

Laura wriggles free from my grasp and charges off, eyeing an LCD panel cable drooping tantalizingly close to the floor.

Fifteen minutes later, I finally find the cause for no sound—someone has recabled the left and right stereo channels out of the switcher located at the workstation. I gaze in relief at the TV screen. Bear is zipping, swooping, and soaring through outer space. The Dolby surround sound is filling the room in dramatic glory. I feel uplifted, victorious.

Suddenly I realize that Laura is no longer in the room. I dash out the door, calling her, imagining the worst. I finally locate her, moments later, having a friendly chat with the evening custodian while swirling her fingers through the grimy water in his mop pail. I scoop up my baby, nod at the custodian, and race back to the classroom just in time to see the bear video come to an end.

"Bear! Bear!" Laura cries, bitterly disappointed. The phone rings. My wife is calling to warn us that dinner is on the table and not getting any warmer. "It's time to come home," she says, "bear or no bear. Right now."

(My wife is no dummy. She has lost her husband dozens of times into multimedia "black holes." She is not really worried that I'll make it home for dinner. What really bothers her is that I—and her daughter—might not make it back before breakfast the following morning.)

I'm caught in an agony of indecision. Should I bail out now, flip the master switch, leave the room dark and silent, and head for home? Or should I risk my wife's wrath and try to track bear down?

Laura looks up into my face, plainly hoping I'll give it just one more try.

The cause is not lost! I spring into action. This time my fingers seem gifted, blessed. For once they push all the right buttons. We find the right frames on the laser disc. All systems are go! Teddy flies back onto the large-screen TV. His dream music fills the room. I lift Laura up into the air and fly her around the classroom, zipping around the workstations, circling around cameras, dipping, climbing, diving. "Bear!" Laura cries, this time with a joyful grin.

"Ahh. Multimedia," I gasp as I lift my laughing baby up close to the ceiling. "There's nothing quite like it!"

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Research Windows

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The Logo Center

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Suppose you have the words "I love you" on the page. Perhaps they are part of a Valentine's day poem that contains the word "love" in several places. You can write a procedure that will replace each "love" with, say, a picture of a heart. First type

```
TOP
SEARCH "love
```

and then remove the word "love" from the text. Type

```
CUT
```

Now it would be nice to insert some space for the heart we are going to stamp. CHAR 32 represents a space, so you can type

```
REPEAT 5 [INSERT CHAR 32]
```

to insert five spaces. Next, you need to move the cursor to the center of the empty space. Type

```
REPEAT 3 [CB]
```

Now you are ready to get a heart costume for the turtle and place the turtle on the cursor.

```
SETSH 14
PU
SETPOS CURSORPOS
```

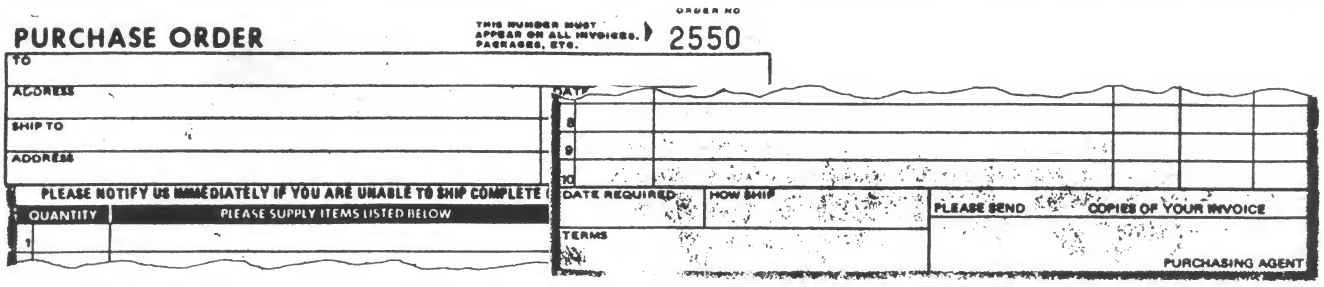
Finally, you want to stamp the heart and move the cursor out of the way.

```
PD
STAMP
BOTTOM
```

By putting these commands into a procedure, you can replace each "love" on your page with a heart.

Text processing in *LogoWriter* provides a whole new arena for "messing about" in Logo. With these new commands and reporters, exploration of language becomes as concrete as exploration of geometry is with the turtle. The explorations are limited only by your imagination! Perhaps these new commands and reporters and the activities described above can provide a welcome change (and challenge) for your students as the winter months approach.

[Sharon Yoder, ISTE, University of Oregon, 1787 Agate Street, Eugene, OR 97403.]


PURCHASE ORDER
THIS NUMBER MUST APPEAR ON ALL INVOICES, PACKAGES, ETC.
ORDER NO 2550
TO
ADDRESS
SHIP TO
ADDRESS
DATE
PLEASE NOTIFY US IMMEDIATELY IF YOU ARE UNABLE TO SHIP COMPLETE
QUANTITY
PLEASE SUPPLY ITEMS LISTED BELOW
DATE REQUIRED
HOW SHIP
PLEASE SEND COPIES OF YOUR INVOICE
TERMS
PURCHASING AGENT

Are You Getting Your Money's Worth?

By Fred D'Ignazio

Cost-effectiveness isn't just a matter of how many computers for how many students. Suppose you get all the equipment you want—what are you going to do with it?

In spite of all the educational technology activities going on across the United States, the following situation is still true: Most technology that is available to businesses and government today is still unavailable in most of our classrooms.

Equally daunting: Much of the technology currently being introduced into today's classrooms will be used to reinforce outmoded, ineffective methods for teaching and learning.

Faced with this situation, school-district technology planning committees should direct the acquisition and implementation of technologies for one overriding purpose: To support teachers in their efforts to adopt new teaching practices and new methods for managing their classrooms.

Unfortunately, some school administrators equate *bricks and boxes* (classroom renovation and technology installation) with school improvement and school restructuring. In fact, modernization of the physical plant and the acquisition of more gimmicks and gadgets may only serve to defuse community pressure for real educational change and may reinforce existing administrative and instructional practices. The result? Existing political and organizational barriers to change are strengthened, and real change is thwarted or postponed.

As exciting and glamorous as technology seems in the abstract, at the classroom level it is inappropriate unless it transforms the methods that teachers and students use, so that all learners can achieve the outcomes necessary to enter the job market in the 21st century and to become a strong, well-informed, and literate citizenry.

Outcomes Focus

What kinds of questions should district technology planning committees ask as they interview technology vendors and try to make sense of the dazzling array of technologies demonstrated before them?

Be picky, be demanding. Trust your own judgment and do not be intimidated by technology jargon. *You and your committee know best what outcomes you want to achieve for your teachers and students.* And remember, we are talking about *your* district's money—and a lot of it!

A zealous, stubborn focus on *instructional outcomes* is essential in assessing whether any given technology or mix of technologies is appropriate for your district, your classrooms, your teachers, and your students. In fact, your focus could be tightened even further—down to the level of the individual student or teacher during a period of instruction, or even to a moment of learning. The questions might be:

- Does this technology improve a student's or a teacher's performance each moment of each day?
- Does technology substantially enrich the learning environment?

Technology has the potential to dramatically improve the performance of teachers and students, and enrich the learning environment. However, in order to produce these outcomes, technology must be used to support the "best practices" for teaching and learning. Technology must create a classroom that encourages:

- Heightened Student Attention, Engagement, and Enthusiasm for Learning
- Inspired teaching
- Students Taking Responsibility for Their Learning and for Coaching Fellow Students
- Student Authoring, Publishing, and Presentations
- Cooperative Learning
- Problem-Solving, Critical Thinking, Questioning, and Analysis
- Collaborative Inquiry, Research, and Investigation

What Makes Technology Worth the Cost?

Unfortunately, technology has enormous drawbacks. It is expensive. It is constantly changing, thereby requiring you to replace installed equipment on a constant, highly costly basis. Also, due to its complexity and constant change, technology is a major headache: Deadends, snafus, "bugs," viruses, and glitches make managing technology a challenging and often frustrating activity.

Despite its high cost, technology can be useful. Technology can be worth the cost if:

1. It enables every student to participate in managing their daily classroom learning, including what is learned, how it is learned, and how fast.

2. It helps the teacher move from her role today as knowledge conduit and the knowledge "spigot" operator to a new role in which she shares her teaching responsibilities with her students and becomes an active learner alongside her students.
3. Technology not only helps transfer some control of learning to the student, but also helps students learn to manage that learning process responsibly. For example, technology might help:
   - Students work together collaboratively to "pilot" their learning experience efficiently toward desired outcomes.
   - Students become responsible for sharing the "teaching load" with the teacher. They can be held accountable for co-teaching and can be given the tools needed to teach their classmates and their teacher.

Common-Sense Criteria

If a teacher, parent, or administrator were to enter a classroom where technology had been "installed," how could they evaluate whether the technology was worth the cost and whether it was being used appropriately?

Here are some common-sense, practical criteria for assessment. If you can answer **NO** to any of these questions, then it is possible that technology is not being used appropriately in a given classroom:

- Are the teacher and students engaged, enthusiastic, inspired, excited?
- Are students *constructing* their own knowledge (authoring, piloting, navigating, retrieving, organizing) or simply consuming knowledge that was created by others?
- Does the classroom working environment for teachers and students resemble a real-world workplace of the future?

Does technology…

- help the teacher and her students do their lessons better, easier, or more quickly?
- encourage students to responsibly manage their learning?
- encourage the teacher to share teaching responsibilities with her students?
- encourage students and teachers to collaborate to construct knowledge, share knowledge, nurture each other's learning, solve problems, and cope with unforeseen events and situations that arise?
- foster increased student manipulation of real-world materials or separate the students from these materials?
- increase constructive communication and cooperation among students? ... among the students and the teacher?
- stimulate individual and group thinking, reflecting, weighing, testing, and experimentation with new ideas and unfamiliar concepts and information?
- offer multiple windows, doors, and pathways for learning, based on students' individual cognitive style and strengths?
- help students and teachers adapt to constant change and offer them healthy change-management strategies?
- help teachers and students create a daily classroom culture that respects and rewards people for being decent, polite, and considerate toward each other?
- help teachers and students create a daily classroom culture that respects and rewards people for working together, constantly shifting roles between teacher and learner; a classroom where the excitement of exploration, mastery, and communicating new knowledge is shared by all and makes each lesson a thrilling and moving experience?
- help improve a student's self-esteem? Does it help improve a teacher's self-esteem?
- help teachers and students experience their humanity in deeper and richer ways, or does it diminish, stifle, or mute their humanity?
- inspire teachers and students? Does it unleash their imaginations? Does it enrich teachers' and students' moral, ethical, and *spiritual lives* and *spiritual nature?*

No technology—present or future—can meet all the criteria outlined above, at any given moment. However, it is important for us to establish these criteria and construct a practical yardstick *at the classroom level* to measure what kind of technology we can afford, what kind we want, what kind we need, and how best to implement it.

This yardstick is needed now, at the beginning of each district's technology initiative. District technology committees need to be demanding, picky, skeptical, and specific. Technology *can* deliver all the outcomes cited above. But it can become an expensive and frustrating distraction unless technology committees make it clear to vendors and consultants *up front* what outcomes they regard as essential.

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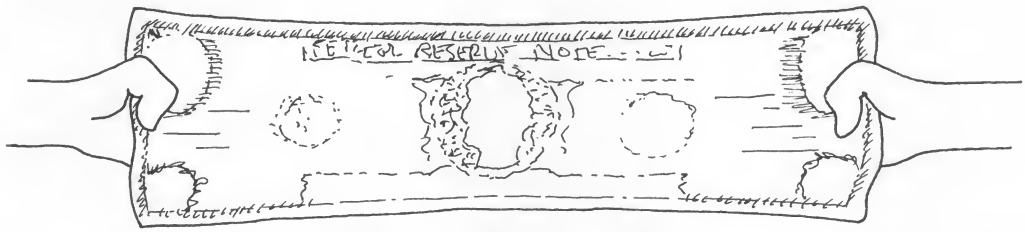
Multimedia Sandbox

Edited by Fred D'Ignazio



"Soft" Architectures for Restructuring: Stretch Your Technology Dollar

by Fred D'Ignazio

Ideas for this month's column come, in part, from Sharon Goth-Tew, my colleague in Michigan's Teacher Explorer Center; Larry A. Freds, Director of Data Services for East Lansing Schools; Larry McGinnis, member, East Lansing School Board; and Dr. William Mitchell, the Superintendent of East Lansing Schools.

East Lansing, Michigan is committed to a restructuring of teaching and learning throughout its 10 school buildings. This restructuring will be supported and augmented by a major investment in technology over the next three years. However, although almost six million dollars will be invested in technology, it is hardly enough to buy all the technology desired. The East Lansing school district is considering three dollar-stretching strategies:

Use students' imaginations in place of expensive machines. Students' imaginations are dirt-cheap, yet they are largely ignored. A low-end multimedia authoring station and inquiry center can act as a *motivation multiplier* to dramatically increase students' productivity, participation, and academic performance while saving a district thousands of dollars.

Hire students as "trainers" and "technicians." Students have tremendous multimedia (cabling, troubleshooting, button-pushing, video, and audio) literacies that are being *wasted* in today's non-multimedia classroom. It's time for school districts to recognize this valuable, inexpensive resource and informally "hire" students as classroom technicians, trainers, and troubleshooters.

Inventory, modularize, network, and *hub.* Districts can get a lot more "bang for their buck" out of technology by:

- *Inventorying* equipment they already have that can be linked together into advanced multimedia stations.
- *Modularizing* expensive multimedia equipment on carts that can be shared across a building on an on-demand, "just-in-time" basis.
- Connecting inexpensive classroom computers to a building-wide *network* that shares scarce multimedia resources and electronically "pipes" resources into the classroom on an as-needed basis.
- Transforming the building's library media center into a multimedia *hub* for multimedia research (capturing, scanning, digitizing, etc.), multimedia networking, instant electronic publishing, and multimedia training.

Restructuring from the Bottom Up

Here is a more detailed summary of some of the "bottom-up" strategies that East Lansing Schools are considering (see Figure 1).

Scavenged Multimedia Workstations in classrooms around the district. "Seed" workstations are supplied by the district. Additional workstations can be scrounged by teachers, students, and parents. They include the following "core-level" equipment:

- Computer
- Video Camera
- VCR
- TV
- CD or Tape Player
- Software
- Wheeled Cart
- Blank tapes, disks
- Dub Cables
- 6-Outlet Power
- Digitizer Card

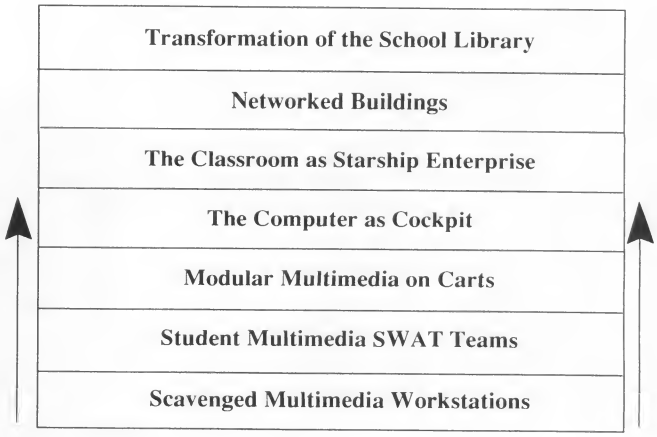


Figure 1. Bottom-Up Strategy for Restructuring

Student Multimedia SWAT Teams. Over the past five years, millions of children have been in their bedrooms working their way through Nintendo Boot Camp. They are now enormously skilled at "multimedia plumbing." They can mix and match complex cables and plumb audio, video, and computer signals with ease, ingenuity, and amazing speed. School buildings need to enlist these Nintendo graduates as troubleshooters, peer coaches, teacher trainers, and roving technology specialists to take the technical responsibilities for multimedia off the shoulders of the classroom teacher.

Modular Multimedia on Carts. Multimedia resources can be brought into any classroom on wheeled carts containing multimedia equipment that is more scarce or expensive and must be shared across a building. Student "SWAT Teams" can dock the multimedia carts with the classroom computer and cable the equipment together to create a powerful multimedia workstation in under five minutes. Individual carts might be equipped with one or more of the following items:

- Dubbing VCR
- A laserdisc player, VCR, and TV
- Overhead projector and data display panel
- Video projector
- Video camera and tripod
- Hand scanner and/or flatbed scanner
- MIDI keyboard, an amplified speaker, and a microphone
- A CD-ROM drive with a case of audio/CD-ROM discs

The Computer as Cockpit. For 50 years we have stuck to a familiar model for understanding computers:

We described computers as "number crunchers" and "data processors." In our minds we saw the computer as a *Cuisinart* that slices, dices, purees, and "processes" information.

Now that computers are turning into desktop PC-TV-CD hybrids (and as they shrink and fit onto our laps, into our pockets, under our desks, and behind our walls), we should search for powerful new metaphors that help us stretch our imagination to recognize radically new human-computer symbioses.

In East Lansing we are replacing the "computer-as-Cuisinart" metaphor with the metaphor of the computer as cockpit. Student explorer teams can pilot their enhanced multimedia stations as "virtual vehicles" to explore and remap their daily lessons into more visual, auditory, lifelike media formats that spark students' imaginations, enhance their understanding of critical subjects, and increase their motivation to learn. Students can take their vehicles to any place or time and learn about subjects they are studying up close, using all their senses, as on-the-spot eyewitnesses.

The Classroom as Starship Enterprise. Student explorer teams can use a classroom network to link their separate workstation "vehicles" into a collaborative super-vehicle for exploration, investigation, and discovery. The teacher can act as the vehicle's "captain" to guide the entire classroom on voyages to explore and map important curricular areas that web or cluster around exciting, powerful themes. The classroom's collaborative mission becomes

the creation of interactive electronic field trips and the building of multi-media simulations of real-world processes, events, and phenomena—nothing less than a student-created, multimedia transformation of the curriculum.

Networked Buildings. Networking a school building allows teachers and students to use low-end, inexpensive computers as classroom workstations. These workstations can be enhanced by scavenging, by docking with multimedia carts, and by being on a building network that pipes in CD-ROM encyclopedias, downloaded files from online information systems, and digitized multimedia files from centralized capture stations in the school library. The network also acts as a school-wide electronic grapevine for constant, intense, student and teacher interaction and cross-classroom communication.

Transformation of the School Library. Everyone in the school building works together to transform today's text-centered curriculum into new student-created multimedia formats. The hub of a school building's multimedia activities is the school library or media center. Here are some of the core functions of a restructured, "virtual" library media center:

- Maintain and improve print collection materials for use in student research and investigation and as a reservoir for rich language for student oral multimedia recordings and for rich images for student digitizing.
- Acquire a basic collection of digital media, including laserdiscs, CD-ROM titles, major videotape titles, audio CDs (including public-domain "clip sound" CD's for student research and publishing projects).
- Wire library into electronic information sources, including cable TV, Prodigy, CompuServe, TI-IN Satellite Instructional TV, and other distance-learning and online databases.
- Wire thelibrary into all classrooms via computer E-Mail and computer network.
- Centralize all building "multimedia capture" devices in the library, including: color and/or gray-scale scanners; audio capture devices; editing (audio/video dub) VCRs and controllers; cameras (still, Polaroids, video, etc.); cartridge CD players.
- Centralize all building, networkable multimedia resources such as CD-ROM optical server "juke boxes" that can pipe up to 28 daisy-chained CD-ROM encyclopedias containing over 7 million pages of information, thousands of images, video and sound clips, and digital movies into low-end classroom computers. Up to 16 classrooms can access each CD-ROM or audio CD simultaneously while on this network.
- Train librarians as multimedia research and publishing instructors. Students and teachers can make appointments to use the library as a *multimedia research and publishing center*. They can carry their multimedia creations from the library on paper, diskette, or videotape; pipe them into individual classrooms in the form of digitized multimedia movies, images, text files, slide shows, and databases; or telepublish, via modem, to classrooms around the school district or to remote classrooms around the country or the world. Teachers and students will be able to use the library "after hours" as a training lab. They can learn new software programs and new equipment that later can be wheeled into the classroom on a multimedia cart or "piped" into the classroom electronically. Teachers can practice teaching familiar curriculum subjects using new multimedia teaching aids. They can experiment creating new classroom presentation materials and interactive "templates" for student assignments. Students can gain practice creating multimedia term papers, book reports, science projects, and presentations.

KISS and the Big Picture

Over the last five months, this column has been a platform for looking at the topic "restructuring using technology" from a practical yet innovative perspective. If your district is interested in using technology (and, specifically, multimedia) to act as a catalyst for restructuring, then you should collect these five columns. Together the columns cover "the big picture" and propose that school districts:

- Create a centralized facility (a Teacher Explorer Center or transformed school library media center) to begin the daily exposure of teachers, students, administrators, and parents to new ideas and new teaching and learning tools.
- Set up a district-wide training program (Pioneers, Explorers, and Settlers) that helps the district prioritize its limited training dollars for maximum impact and effectiveness.

- Design a program to funnel students' vast technological aptitudes and literacies into the restructuring process (e.g., through student multimedia trainers, Nintendo "SWAT" Teams, teacher-student contracts, etc.).
- Link the various "soft" architectures for restructuring covered in this article with the "hard" capital-intensive architectures of planning for new buildings and expensive new equipment.

To get started, keep your sights set on three fundamentals:

1. Encourage your teachers to take a leadership role in the change process.
2. The classroom is where learning takes place, so focus on the classroom, on students, and on learning itself. The rest will fall into place.
3. KISS—Keep It Simple to get Started. Keep It Simple to Succeed.

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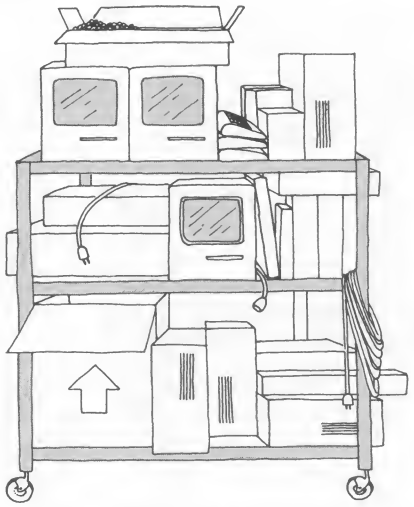
Multimedia Sandbox

Edited by Fred D'Ignazio



Technology vs. Restructuring: Beware of the Quick Fix

by Fred D'Ignazio

In the next two columns we'll look at how technology is viewed as a shortcut to school restructuring. We'll begin by examining the massive rebuilding effort that is underway in American schools to convert 19th-century classrooms to technology-intensive, "intelligent" classrooms of the future. Next we'll examine the notion that high tech automatically produces restructuring. Last, we'll look at the key (non-technology) variables that produce real restructuring, and we'll search for a new role for technology that is more realistic and affordable than the messianic "quick fix" promised by some technology vendors and educational consultants.

The "Hard" Architecture of Technology

School districts are climbing on the multimedia bandwagon and planning new high-tech classrooms as "delivery vehicles" for a 21st century multimedia curriculum. Examples of "hard" architectures for delivering multimedia include:

- Raising classroom floors and lowering classroom ceilings to hide the multitude of power and signal cables required for integrated, audio, video, telecommunications and computer network technologies.
- Converting the five or six AC electrical outlets in the average classroom into dozens of *information outlets* that deliver power, digital audio, video, cable-TV, and computer signals over fiber optics or enhanced copper wire.
- Creating hidden rooms adjoining classrooms connected by a *video wall*. The hidden rooms contain the "server" computers for various computer networks, the Barco (or other-brand) rear-screen video and data projector, the satellite-dish control boxes, the VCRs, laserdisc jukeboxes, etc. for classroom presentations.
- Connecting the classroom and school building to district-wide networks and global electronic highways by:
  - Setting up satellite dishes on school building rooftops.
  - Installing fiber optics cables throughout a district.
  - Installing a TV in each classroom wired to a central video transmission facility in each school. Teachers can call up a video of their choice on their classroom TV as easily as they can order a pizza from the local Pizza Hut.
  - Creating *teleclassrooms* (via fiber optics cable or via satellite instructional TV) that pipe in master *teleteachers* who offer courses that cannot be offered on-site by other teachers in a given school building or school district.
  - Installing phone lines in each classroom and setting up computerized "phone mail" answering systems to link teachers to each other and to their students' parents.
  - Installing modems and fax machines in the school office or library for centralized communications and retrieval of information from online information services.
- Installing networked multimedia ILS's—Integrated Learning Systems—that soon will be delivering the entire K-12 curriculum via CD-ROM, microphone, headphones, and multimedia sound, graphics, animations, video, etc.

A False Recipe for Restructuring

The word "restructuring" to many educators is a brick-and-mortar term. When coupled with technology, it sounds as if schools can prepare for the 21st century by constructing new school buildings to house the latest, hottest, new gizmos and gadgets brought to us by high-tech vendors.

Educators are sometimes misled into thinking that architects can take care of restructuring for them—that, somehow, restructuring of learning will take place simply by embedding new technologies into new, electronic school buildings and new technology-saturated classrooms. The "quick-fix" recipe for restructuring is:

NEW TECHNOLOGIES
+ NEW SCHOOL BUILDINGS
= RESTRUCTURING

This recipe is seductively appealing, but it is a myth.

Unfortunately, some educators and educational consultants give most of their attention to the "hard" architectures of technology (listed above) and ignore the messier, "softer" architectures of restructuring. They want a logical, clean, "turnkey" solution to education's problems, and

they are willing to spend great amounts of money to get what they want.

In fact, modern buildings and more technology do not necessarily produce better teachers or better students. Also, more technology is not necessarily any better than less technology. And more available technology does not necessarily mean more *used* technology or more *useful* technology.

Tough Decisions

Restructuring is not something you can buy. It is not a product of expensive new technologies or the result of putting students and teachers into electronics-laden classrooms.

This is the easy way out. And it can be an expensive distraction, or, worse, a deadend.

Restructuring is something that is hard-won, something that is based on making tough decisions and attempting to make fundamental changes in the way people teach and learn within individual school classrooms. Restructuring decisions involve:

- Changing the ratio of students to teachers.
- Altering teachers' salaries and salary incentives.
- Changing teachers' professional responsibilities, self-image, and expectations.
- Redesigning the daily and yearly class schedule.
- Changing the number of hours school is conducted each day and the number of days school is conducted each year.
- Changing the way teachers become teachers.
- Changing the training that teachers receive on the job.
- Redesiging the curriculum.
- Changing the way schools are financed, teachers are certified, and districts accredited.
- Changing (and "flattening") the administrative and bureaucratic structure of schools.
- Changing the way parents choose schools.
- Changing the way parents interact with schools.
- Changing the mission statement for schools. *(Just what is the purpose of school?)*

Restructuring can be supported by new building architectures and new technologies. But new buildings and new technologies, on their own, will not produce restructuring.

Restructuring is, over the long run, the radical transformation of American schools and American schooling. Therefore, restructuring is complex, expensive, probably painful, and something that cannot be accomplished overnight.

Restructuring is not about machines or buildings. It is about *people*. Restructuring affects every facet of the way schools are run.

Restructuring Catalysts

There is no single factor, ingredient, or change that will produce systemic restructuring throughout a school building or across a school district. However, there can be catalysts for restructuring that can help spark restructuring—at least in limited areas or for limited subjects or groups of teachers. Multimedia might be such a catalyst.

If we limit the grandiose claims made by technology vendors and the grandiose fantasies of educational consultants and some educational administrators, multimedia might play a part in sparking restructuring in three limited though critical areas:

- How teachers teach
- How students learn
- How curriculum is "delivered"

A "Soft" Architecture for Restructuring

Next month we'll look at a strategy for using multimedia as a catalyst for restructuring. The trick is to remember that "hard" architectures of buildings and machines are not magical keys to restructuring. In fact, a flexible, dynamic architecture of restructuring that alters the way classroom learning takes place might be concocted out of existing buildings and existing machines.

New ways of organizing classroom learning using multimedia tools might be described as a soft architecture for restructuring. This soft architecture grows out of how teachers and students think about their daily jobs of teaching and learning. It grows out of an emerging understanding of how teachers and students can transform their daily lessons into new multimedia formats that spark greater student motivation, creativity, and academic performance.

By focusing on people first and by building expectations for restructuring gradually and incrementally from actual classroom experiences and using existing equipment and buildings, the soft architecture strategy can produce realistic expectations, real results, and can be more affordable for districts on a limited budget.

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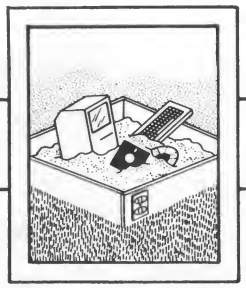

Multimedia Sandbox

Edited by Fred D'Ignazio

A New Curriculum Paradigm: The Fusion of Technology, the Arts, and Classroom Instruction

In the past, teachers could teach by simply standing in front of their students and talking, or walking to the blackboard and writing lists of words or mathematical symbols and supervising student transcription of these symbols.

In the past, students could walk to the front of the classroom and read a report, word for word, without looking up from their papers. Like their teacher, they felt comfortable squirting an unbroken stream of words at their classmates, words unsupported by any other media, unaided by any other representations of knowledge.

In the past, during classroom presentations, the class's interaction with the primary speaker was minimal, limited to occasional questions and responses. It was considered acceptable for the class to remain in "input" mode for minutes or even hours at a time and simply "consume" knowledge as it was doled out, word by word, symbol by symbol.

In the past, teachers had to do all the work in the classroom. In the past, teachers had to take responsibility for most of their students' learning.

Today this type of learning is no longer workable, especially in a classroom filled with MTV-and Nintendo-saturated children. In the last two years powerful new tools for classroom instruction have become available that make it possible for classrooms to be more interactive, for vast quantities of information to become a daily part of student's educational "diet," for students and teachers to make presentations that are dramatic, moving, compelling, and instructive. These tools can transform every subject teachers teach and students learn.

Using new multimedia tools, it is possible for a classroom teacher and students to take an electronic field trip into worlds of knowledge, to immerse themselves in the sights and sounds of history, art, literature, geography, and science. Students can stand, face to face, with historical figures, watch them soar and flounder, peek at spinning molecules close up, and conduct history-making science experiments in the simulated labs of famous scientists and inventors. With a little bit of training and money, teachers can revamp classroom instruction using tools that are already on the market today.

Widening the Definition of Knowledge

Multimedia knowledge is nothing less than the reconstruction of knowledge. In the past, teachers taught new knowledge on two narrow wavelengths, text and talk, using written words and spoken words. All knowledge was funnelled into abstract systems of linguistic and mathematical symbols. This was a practical solution, given the primitive nature of classroom audiovisual tools.

Now this narrow representation of knowledge is no longer necessary. New computer synchronized multimedia make it possible for teachers who have little technical training to present critical subjects to students using moving images, full-motion video, graphics, colorful animations, speech, music, and powerful audio environments. Students will experience the joy and illumination of creating multimedia knowledge representations of their own. Different learning styles and intelligences will be supported. As the definition of knowledge is widened, new gateways to learning will become available to learners who in the past were shut out or forced to learn in ways that were difficult, or, for them, unnatural.

From Textbook to Linked Knowledge Base

In the classroom of the past the teacher only had to have mastery over the spoken or written word or over the ordering of mathematical symbols. Now, with multimedia learning, a teacher will need to know about visual knowledge, visual communication, images, auditory communication, music,

dramatic speech, body language, and body movement. A teacher who felt able to recognize a decent sentence or paragraph might feel cast adrift in a classroom in which knowledge is expanded to include segments of video, passages of music, dazzling computer animations, and hypermedia "knowledge bases."

What is a knowledge base? It can be an event—a sequence of sounds and images presented in a linear stream over time. It can be a picture—a single image consisting of a multitude of complex components all presented simultaneously in a single instant. It can be a succession of screens (pages in a folder, cards in a stack). The screens are "glued" together topically in a linked knowledge system, accessible by pointing an on-screen arrow at *buttons* that take you to related topics and alternate representations of a single topic.

All these new representations of knowledge must surely send the average teacher into a panic. How can a teacher translate what he knows into these new systems? How can he teach using these new methods? How can he evaluate what the students are creating? Is the students' work genuine—representing intellectual originality and integrity—or just glitzy hypermedia gobbledygook calculated to blow the teacher away?

The Art Teacher as Consultant

The classroom teacher needs help. And it exists right in his or her building.

Enter the art teacher. Enter the music teacher. Enter the drama teacher, the dance teacher, the library media specialist, even the football coach, the soccer coach, and the tennis coach. These professionals who once lurked on the periphery of curriculum, instruction, and academic learning can now become valued consultants to teachers and students who aspire to become multimedia authors and who, as multimedia navigators, wish to evaluate knowledge bases created by artists, dancers, moviemakers, and musicians.

It's time to reach out, time to form cross-departmental curriculum teams. It is time to set standards—criteria for *creating* new knowledge and for *judging* new knowledge as it is created. Districts that are spending thousands of dollars on new technology cannot continue spending their scarce funds in a mono-disciplinary vacuum, relying only on the technical expertise of their computer coordinator or technology specialist. They must invite the art teachers, the music teachers, the drama teachers, and library media specialists to sit on their committees. They must take the decisions out of the purely technical domain and start thinking of *the reconstruction of knowledge that has already begun in their classrooms.* Who is competent to judge knowledge as imagery? Who is competent to judge page layout, page design, screen design, musical soundtracks, knowledge as multimedia stacks, folders, and three-dimensional tiers of webs?

Classroom teachers can enlist their colleagues to train their students to create classroom presentations that are more polished, professional, and compelling. Classroom teachers and their students can learn *design techniques* that will help them organize images and sounds over time, to become *knowledge architects* of two-dimensional and three-dimensional space, to learn new methods of presentation, and how to use their voices and bodies to communicate in the same way they now organize words on a page.

Art Is Not for the Arts Only

This will be a difficult time for classroom teachers *and* for their consultants from other fields. Neither side is used to collaborating. Neither side really values the other. Art teachers taught art for art's sake. Classroom teachers taught knowledge without seeing the need to represent knowledge visually, aesthetically, or according to *any performance standards* other than the printed script.

Now times are changing. Art and music teachers and others could play a central role in redefining classroom curriculum around broader, multimedia representations of knowledge. Students' mastery and communication of that knowledge can be improved immensely with their skills and expertise.

Art teachers also teach differently. They don't try to teach students a body of facts ("knowledge"). Instead they try to spark the creative impulse in each child and guide them using materials, examples, and basic methods. Student apprentices in the art room gain the experience of working with a master.

The Danger: Clip *Everything*

If classroom teachers and their colleagues in the art, music, and other departments do not collaborate, then classroom teachers and their students will be forced, through lack of skill, training, and vision, to resort to *clip art* instead of original, student-created art, and *clip sounds* instead of real sounds and music they create themselves. Multimedia makes it simple to capture other people's images, sounds, and text and paste them into a work that you call your own. Everything the students create can be lifted from some other author or artist's work and patched together to create a crazy-quilt student report, term paper, or project.

If students and teachers do this, they risk their intellectual integrity, and their actions verge on piracy and multimedia plagiarism. More importantly, they will never experience creating something entirely *new.* They will never experience the profound emotional and intellectual joy of crafting something personal that is entirely their own.

The tools exist for students and teachers to create multimedia knowledge from scratch. But they can never be used to their full potential unless experts in the visual, sound, drama, body-movement, and other knowledge domains are consulted and have the opportunity to train students and support their efforts to communicate critical subjects through multimedia presentations.

Where Is The Audience?

We are on the threshold of a new era in human knowledge, human communication, and human culture. The methods for creating and propagating knowledge are about to be transformed. In the present era, using the old media, the world is stratified into two classes: the *producers* and the *consumers.* I produce, you consume. I create, you use. I am an author, you are a reader. I am a performer, you are my audience.

In the emerging world of *interactive knowledge*, the line between these classes breaks down and blurs. In the world of interactive media there is no producer and no performer because we are *all* producers and *all* performers. In the world of interactive media, there is no audience because the audience is made up of producers and performers who are *interacting with the performer's materials as actively as is the performer.*

Can art teachers embrace the new interactive visual media? Can music teachers master the new interactive auditory environments? Can either profession sacrifice the control and narrow prestige they enjoy now and venture across disciplinary and departmental lines as enthusiastic collaborators with classroom teachers?

Hopefully they can. And if they do, everyone will benefit—especially the students.

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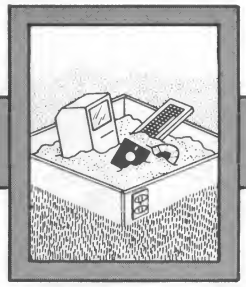

Multimedia Sandbox

Edited by Fred D'Ignazio

Multimedia Training Centers: The Highest Tech At Affordable Prices

By
Fred D'Ignazio

Multimedia's Price Tag

Multimedia is the hottest new technology in schools. Unfortunately, multimedia is awfully expensive!

Schools used to worry about finding the funds to purchase computers, but computers are only part of the learning environment in a multimedia classroom of tomorrow. Schools wishing to set up interactive multimedia classrooms must find the money to purchase computers, VCRs, camcorders, laserdiscs, large-screen TVs, LCD panels, video projectors, scanners, digitizers, network controllers, CD-ROM players, modems, satellite dishes, cable-TV hook-ups, telephone lines, and the software to make everything run.

And don't forget the new media—the interactive multimedia software like MacroMind *Director 2.0* and Autodesk's *Animator*, and the laserdiscs and CD-ROM discs with rich curricular material. None of these products are cheap. For example ABC News Interactive's *Martin Luther King, Jr* package (which includes a two-sided 12" laserdisc plus HyperCard software) retails at $395; Compton's CD-ROM *Multimedia Encyclopedia* costs approximately $1,000; the Grolier CD-ROM *Electronic Encyclopedia* for a computer network costs $3,000.

A single multimedia learning center for a classroom can easily run between $10,000 and $15,000. Four student stations and a teacher station in a classroom may cost $35,000 or more. And a multimedia lab can cost upwards of $500,000.

Few schools will be able to afford such a high price tag. Wealthy schools will end up with magnificent multimedia classrooms, while the majority of schools will be left behind as multimedia "have-nots."

Scavenged Multimedia

One route schools can follow is to scrounge multimedia from nooks, crannies, and dusty supply closets around the school building. Schools forced to do multimedia on a shoestring can build a classroom multimedia center out of a "scavenged" low-end computer (e.g., Apple IIe, Commodore 128, Tandy 1000, or IBM PCjr), a Califone record player, a VCR, and a TV. Software for the center might start with *Slide Shop* from Scholastic or *VCR Companion* from Brøderbund. Even with the software, a few audio and video cables from Radio Shack, and a blank tape or two, costs for a scavenged center can be kept under $100.

Schools can get tremendous benefit out of scavenged multimedia. Teachers can use the center as a "presentation station" for classroom lessons. They can videotape software tutorials directly from the computer (by cabling the monitor jack on the computer to the VIDEO-IN jack on the VCR, inserting a blank videotape, and pressing RECORD). Students can create video book reports, video term papers, and video science projects by taping graphics screens off the computer onto videotape and by adding music and sound effects from the record player. (All this can be accomplished by cabling the output jack on the record player to the AUDIO-IN jack on the VCR).

If teachers put their scavenged center on wheels, they can roll it around the school! Now students in several classrooms—and in art class, music class, and the media center—can gain exposure to multimedia by sharing a single mobile center.

Scavenged multimedia offers the biggest bang for the smallest buck. Student multimedia authors can make the driest areas of the curriculum come to life through multimedia presentations that combine sounds, colorful text, music, and computer graphics. And all this can be done on equipment commonly found around most schools.

Racing into the 21st Century

Using scavenged equipment to build a multimedia center gives schools the ability to begin experimenting with multimedia today despite the limited budgets. Schools can repurpose discarded, leftover equipment to put their teachers and students on the cutting edge. Overnight they can go from projects that were "state of the past" to projects that are state-of-the-art. They can get

more use out of what they've already got. Few schools can afford to pass up this sort of opportunity.

Unfortunately, there is also a down side to scavenged multimedia. While schools are busy scavenging old record players, cassette players, TVs, VCRs, and computers, the rest of the world is racing into the 21st century. Businesses are investing heavily in high tech and acquiring the latest multimedia devices for their employees. The advances in multimedia computing are mind-boggling. If schools remain at the "scavenger" level of multimedia for too long, they will miss a revolution in communications, training, and learning of enormous proportions.

Advanced interactive multimedia is already being used to create training stations for corporate employees. It is used to conduct two-way, full-motion video conferencing among employees scattered in far-flung locations around the globe. Companies are creating multimedia "kiosks" and information centers that orient visitors, advertise new products, train new personnel, and act as sound, video, and animation front ends to corporate data bases. In corporate briefings and meetings, dry statistics and reports are being transformed via multimedia into interactive presentations composed of imagery, music, and the dramatic use of voice, graphics, and sound effects.

Multimedia is helping companies run their businesses more efficiently, train their employees, and sell more products.

It should also be used in classrooms to help students learn.

School/Business Partnerships

Schools don't have the financial resources to buy the latest high-tech equipment, especially since that equipment is changing so rapidly. However, it is possible for schools to form partnerships with businesses to gain access to the funds for new equipment.

Businesses all around the U.S. have expressed an interest in helping schools improve the quality of public education. Most businesses have been motivated by the need to train students in equipment and skills they will need for the workplace of the future. Schools can form a partnership with local business that helps them gain access to high-tech tools they otherwise could not afford. Businesses benefit by helping to train the future workforce in their local community. And they, too, gain exposure to equipment, training programs, and facilities that otherwise might not be available.

Multimedia Training Centers

Many schools already run training courses in the evenings for employees of local businesses. The courses are usually held in a school's computer lab and are run by local high-school teachers and students (acting as teachers' aides). The schools charge a fee to companies who send employees for training. The fees provide valuable financial support to help the schools maintain their current equipment and upgrade the equipment with new equipment as it becomes available.

This same concept can be applied to multimedia training and equipment. An enterprising school district can put together a plan for a new multimedia training center, and then invite representatives from local businesses to a presentation on that center. The center can be located on-site at the high school and be staffed by high-school teachers and students. As "founding sponsors" of the center, businesses will contribute the funds to help the school district acquire and install the multimedia equipment and software and train high-school personnel. In return, the businesses will be able to send employees to be trained in the center. Once their training is complete, business employees, school teachers, and students can work together to develop special multimedia presentations and training programs customized for the needs of the sponsors.

Everyone benefits. Schools get to acquire and expose their students to the latest in high tech equipment. Businesses receive good local publicity for supporting schools, and they get a chance to train their employees on equipment that is probably just as new to them.

The longer-term benefits may be even more important. Schools and businesses will have an opportunity to work on projects of joint interest. Students and teachers who visit businesses to help them with their multimedia presentations and training will acquire a first-hand knowledge of how the businesses really work. Businesses who send employees to work in schools will start to appreciate the complexities of public education. The community as a whole will benefit from the closer ties between their businesses and their schools.

[Fred D'Ignazio, 1302 Beech St., East Lansing, MI 48823.]

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Advertising Index

MINICENTER RECIPES

OPPORTUNITIES FOR AUTHENTIC PUBLISHING

At a recent annual conference of the International Reading Association, speakers encouraged teachers to plan more technical reading and writing activities for students of all ages. Their recommendations are timely. In the future we will be surrounded by machines and by complex social, organizational, and technological processes. We will need to read manuals in order to operate these machines and manage the processes. This skill will be essential for most jobs and for daily living. Yet few people today have adequate technical reading skills. Fewer still have the ability to describe complex procedures involving numerous discrete steps.

In my previous column, I described how teachers could create a publishing wheel of minicenters with their students. I listed various ingredients students could use to assemble centers that would help them create sounds, images, videos, and text that really said something. Now, the next step is to have students create the system for training each other on the minicenters. This is an example of authentic publishing, which has been overlooked but has great potential as a means for developing students' skills in communicating, thinking, and collaborating.

Authentic Authoring and the "Test Pilot"

When students write short minicenter recipes (see the template on page 63), they are meeting two key tests for successful authentic publishing:

1. They have a real audience—other students who need a quick way to master the new center.
2. They have an impact—if their recipes are effective, the other students will learn quickly and easily.

Student writing teams get immediate and authentic feedback on their work. If their directions are unclear or inaccurate, their student testers ("test pilots") will falter and fail to complete the procedures. It is fascinating to watch student writing teams as they observe the test pilots at work. At first the writers are convinced that test pilots have feeble minds because they appear to be confused about procedures that the writers think are perfectly straightforward.

Only after gentle coaching from the teacher do the writers realize that the recipe steps that seem clear to them perhaps aren't as clear to someone who has no experience using the new procedure. As soon as the team starts to accept the testers' authentic assessment of their work, they become more like professional writers. They begin to choose their words more carefully to guide the learners, step by step, through a new and unfamiliar process. At that point, when the members of the writing team see a test pilot succeed in using their recipe, they experience a burst of pleasure and pride, and they develop a renewed commitment to make their recipe even better for the next student tester.

Tips for Better Recipes

It is important to keep the feedback loop for publishing as tight as possible. Student writing teams need to create, test, and publish their recipes over as few days as possible. This keeps the teams dedicated, focused, and efficient. Students should create recipes no longer than one page. Shorter recipes are best—keep recipes from 10 to 20 steps if possible. If a particular procedure is more complex and requires several levels of steps to complete, break it into logical parts so that several teams can tackle and test each individual level.

Teachers need to take plenty of time to prepare and brief the writing teams before they begin working with student test pilots. Writing teams should be prepared for the test pilots to be puzzled and confused by some of their recipe steps. When this happens they should be "scientists" or "researchers " and separate their emotions from the job rather than become frustrated and impatient with their classmates. They need to observe the test pilots carefully so that they can alter the instructions to make the difficult or puzzling parts clearer and simpler to follow. Student writing teams can take real ownership of their minicenters by acting like trainers and teachers to the other students rather than like experts who are reluctant to share their knowledge.

Different Recipes for Different Chefs

Teachers need to define "publishing" as broadly as possible and help students understand that their recipes may be used by students who learn new skills differently than they do. The Minicenter Project Summary template on page 63 lists several learning styles. The various learning styles should be described for the student writing teams, and they should be given examples of ways they can republish their recipes to teach what they know to a variety of learning styles. Students should be encouraged to publish their recipes in one or more of the following media:

- *Printed recipes in a classroom recipe book.* This step should be required for every recipe.
- *Recipe posters to be hung above the minicenters. These are very* helpful, and they promote great "pride of authorship" among writing teams.
- *Student-narrated video recipes.* The videotaped recipes can feature

screenshots of the actual computer programs found at the publishing minicenter.

- *Student-narrated audio recipes.*
- *Diskette-based tutorials.* Programs such as *ScreenCam* (Lotus) allow students to create minimovies onscreen, complete with mouse movement and screen changes accompanied by a student-scripted voice narration.
- *Videotape of a "cooking class."* A video of the writing team leading a tutorial for the entire class or for another team would be a good learning tool for future learners, especially if the tutorial's attendees were encouraged to ask questions.
- *Desktop-published calling cards.* These business cards (see Figure 1) list students' specialties so that the teacher and other students can call on the students as a consultant or trainer.

The Teacher's Role

Teachers need to take advantage of the recipes as a means for personal skill development and in-class inservicing. Teachers in a room full of recipe-writing students have the unique opportunity of having the authors of a technical manual (the classroom "cookbook") as their "employees." Teachers can demand a high level of accuracy, clarity, and simplicity, as well as good grammar and punctation, in all writing submitted for their approval.

Teachers must stay in the cookbook-creation loop. They must test every recipe. If the recipe doesn't work, it goes back to the drawing board for further debugging. Teachers can learn new technology just as well as children can. They just need clear, concise instructions. That is not too much to ask for—especially from one's own students!

Everyone Becomes a Master Chef

Teachers who divide their classes into teams of recipe writers and use this as a vehicle for technology innovation and assimilation will accelerate everyone's learning. The ripple effect of this procedure is extraordinary. If it is carefully implemented and organized, everyone in the classroom will become more technically literate even before the end of the first month that the procedure is in place. And as new equipment and new software become available, students and teachers alike will be hungry to get their hands on it because they will have the skills to "tame" it and turn it into a new tool for learning and instruction.

Student outcomes will be significant. Students will strengthen their writing, technology, thinking, and communication skills, as well as their ability to work together in teams. They will develop a sense of pride, self-esteem, and ownership in their recipes, their minicenters, and the entire process of classroom innovation and mastery of new technology. The "writing team" strategy succeeds because it fuels student motivation and student skills in all other areas of academic instruction.

Teacher outcomes will also be significant. This strategy of cookbook creation is a disguised inservice program for the teacher—right in the classroom! It provides an opportunity for teachers to learn new skills and content knowledge related to their discipline or specialty. And by taking the students' recipes seriously, teachers create an authentic assessment that links their learning directly to the quality of the students' writing. By effectively managing student writing teams, teachers can dramatically accelerate their own learning and personal growth. ■

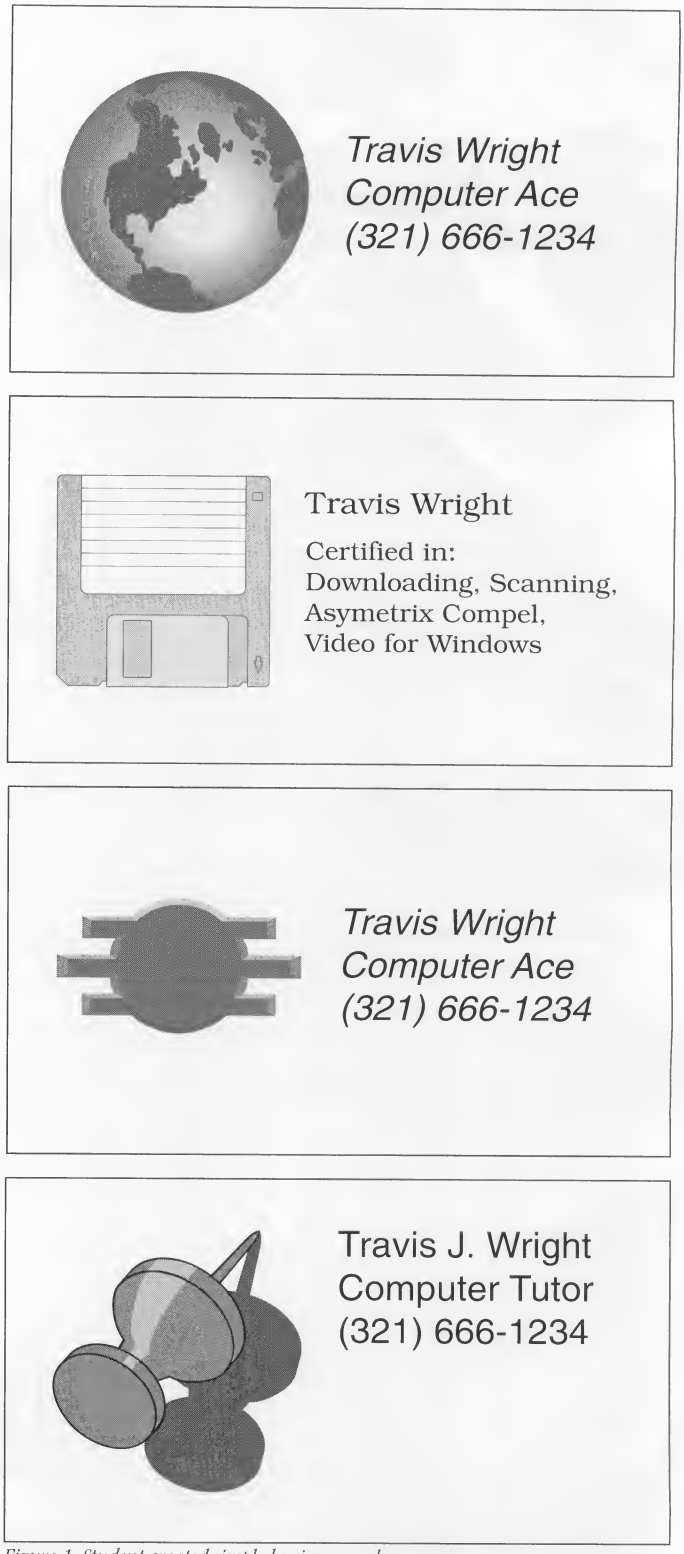

Figure 1. Student-created simple business cards.

[*Fred D'Ignazio, Multimedia Classrooms, Inc., 4121 Okemos Road, Suite 24, Okemos, MI 48864; dignazio@msen.com*]

The Technology Administrator's Field of Dreams Dream Number 2: Technology as a Solution

In my last column I suggested that schools are slow to adopt new technologies in part because technology administrators may be building a "field of dreams" technology plan based on outdated myths about technology that are still common among most adults.

I'm 46 years old, and many technology administrators are approximately the same age (mid-30s to mid-50s). When we were growing up in the 1940s, 1950s, and 1960s, we watched the same sitcoms ("Father Knows Best," "Donna Reed," "Ozzie & Harriet") and the same TV commercials, and we learned that technology is our servant, our friend. We learned that technology means progress, convenience, and improvement in our quality of life. In short: "It brings good things to life."

As a result of our upbringing, members of my generation still see technology as:

- A vehicle, like a car from Detroit, that carries us someplace new and better.
- A *simple, reliable*, push-button appliance that provides immediate gratification.
- A Cuisinart food processor that takes raw input and converts it to useful output.
- A labor-saving tool, such as a lawn mower or dishwasher, that makes our lives easier.

All these notions of technology are accurate for certain kinds of machines (e.g., automobiles and toaster ovens) that automate physical labor. They are mature technologies. They are tame, stable, and not subject to random, unpredictable changes. Unfortunately, these notions are wrong when it comes to information and communications technology. We should all begin to question these notions of technology we picked up when technology was very different. Here are some questions we should ask.

Is technology stable? Information and communication technologies, such as computers, fax machines, copiers, printers, TVs, and telephones, are anything but stable. In fact, they violently thrash about in abrupt, discontinuous, and startling mutations. And the period between these mutations keeps shrinking. State-of-the-art technology quickly becomes obsolete as it is surpassed by wave upon wave of even newer technologies.

Does technology automate physical labor? The new electronic technologies are not the mechanical oxen and donkeys of yesteryear that automated physical labor. Instead they automate mental processes. They are brain machines: communicators, thinkers, organizers, problem solvers, collectors, aggregators, and dispensers of languages, ideas, knowledge, and even thoughts. As Alan Turing aptly observed half a century ago, these machines are capable of simulating any other kind of machine, system, or organism existing in the real world. . . or beyond.

What is technology's impact? The new meta-machines are daily becoming more pervasive and intrusive. Sometimes invisibly, and sometimes rudely, they infiltrate our lives. They are becoming an intimate and necessary part of the way we work, the way we learn, and the way we play. The computer chip (semiconductor) industry is expanding explosively, as small microchips, like cupid's darts, are flung from factories and disappear inside our appliances, our homes, our clothing, our media, our toys, and even our bodies.

Is technology merely a machine? The newest technologies are primarily nonphysical objects embodied in the software that drives the microchips and, increasingly, all other machines. The most evolved form of technology, therefore, isn't physical at all. It's not a software disk, either—it's not even the bits stored on the disk. Instead, it's an information event, a stream of bits in motion—commands, instructions, functions, and processes—when the software is actually running.

Technology only becomes real during runtime. It is a transient, constantly changing machine that is simulcast across the globe and deep under the seas at near the speed of light. It ricochets and caroms off TV stations, hospital operating rooms, bank ledgers, and robot probes blasting into interplanetary space.

Myth: Technology as an Appliance

What differentiates information and communications machines from older technologies? Here are five characteristics of electronic technologies that make them different from older forms of technology:

- They are in constant mutation.
- They have instant obsolescence.
- They offer throwaway disposability.
- They are linked to every human endeavor.
- They are a medium for the mind, senses, and imagination.

The new technologies are transforming the world. They are radically altering all our activities and shaking up our notions of reality. But when we confront how computers are used in schools, we see that the old myths are still in charge. In schools we still see computers as:

- Instruction appliances
- Electronic typewriters, file cabinets, and adding machines
- Paper and book look-alikes
- Digital drillmasters, foremen, and bosses
- Pet rocks, white elephants, and high-tech doorstops

Computers: New Wine in Old Bottles?

We insist on using computers in the same ways we used the older machines. But that hasn't kept us from catching a severe case of

technolust. As a bonanza of new boxes floods the market, our hunger for high tech grows and grows.

Locked inside an antiquated dream, we resemble joggers huffing and puffing on a George Jetson treadmill. As we chase after the flood of elusive new technologies, we frantically spend more money, buy more boxes, and run faster and faster just to stay on the cutting edge. But as many districts have already discovered, the cutting edge can become hazardous to the pocketbook. And districts often begin racing so fast that they can't stop spending.

Unfortunately, the cutting edge keeps receding over the horizon. Meanwhile, school districts' budgets are notoriously limited. This makes keeping on the cutting edge nearly impossible.

The outcome? There is a growing gap between what districts are spending on technology and what technology can deliver. Districts that relentlessly pursue the cutting edge face the danger of running short of funds and risk a backlash from disappointed school board members, teachers, and parents.

Is Technology Really a Solution?

Computer salespeople race from school to school like fiery evangelical ministers. They preach the gospel that technology is a solution to all of a school's problems. According to technologists' scriptures, if we only have faith, not only will technology raise test scores but it will also get the district's kids into college and land them glamorous new jobs.

Technology has become the "S" word. With it a little boy or little girl might become Superman or Superwoman. Technology delivers Success because technology is the ultimate Solution. This type of thinking is so pervasive that we rarely stop to question it. But is technology really a solution?

I dramatize this question in my speeches around the U.S. by hooking up dozens of multimedia devices at my speaker's table and then yanking up the table skirts to reveal the spaghetti of cables lurking underneath. "Does this look like a solution?" I ask my audience. "Or does this look more like a problem?"

Maybe we should begin talking about technology as the "P" word (for Problem) instead of the "S" word (for Solution). Would you call something a solution that costs more money every year, changes constantly, requires incessant training and retraining, breaks down constantly, and mutates unpredictably?

The new technology is hardly the tame little appliance that computer vendors picture it to be. Instead, it's more akin to a tempestuous sea or a wild, unruly habitat. Human beings have chosen this habitat, and we must now learn to develop coping skills in order to survive in it. It's our future. And even more importantly, it's our children's future.

We are like addicts suffering from an acute case of denial. In the 1940s and 1950s we dreamed of technologies that would make our lives simpler and easier. But our dreams didn't come true; the reality of the 1990s is very different from what we expected. Yet we are still locked inside these dreams of futures past. We still dream of a George Jetson future with a one-button classroom. Smiling teachers dressed in lab coats or hokey sci-fi movie costumes carry around a little miracle zapper that delivers instruction to chipper, perky little students with the click of a button. But is this the reality in your school? Would you even want this to be the reality in your school?

Hordes of Cranky Teachers

If we don't want this reality, it's time to examine our notions about technology and search for realistic images of the way we actually use technology. If we accept the fact that technology creates at least as many problems as it solves, we can begin to rethink our image of the classroom of tomorrow.

As long as we look at technology as a solution, all we will ever be is cranky. We will be cranky when the printer breaks down, when students trash the files on our network server, and when the overhead projector bursts a bulb or blows a fuse. In every technology-using school, we are surrounded by cranky teachers. Why are these people whining, moaning, and complaining? Because teachers have been told over and over that technology is a solution. And, over and over, as a solution, technology fails to deliver. This makes teachers, like all normal people, a little testy.

But what if we confessed to the truth? What if we admitted that technology is really a gigantic problem? If we faced this truth head on, we would be looking at an extraordinary opportunity for every school in the country, no matter what the state of their pocketbook, expertise, or experience with technology. Technology is the most wonderful environment for problem solving that's ever come down the pike. And isn't that what we are supposed to be teaching our students? We walk around mouthing educationese about "critical thinking" and "cooperative learning" and "team problem-solving." Yet we now have the most pressing reason to develop these skills, and no one even notices. But if we recognize technology as a problem, we have a perfect environment to put into use the new teaching practices being preached to our teachers.

Are You a Victim or a Survivor?

Let's face it: With technology you are either a victim or a survivor. It's time to teach our kids and teachers the coping skills they need to survive in a high-tech environment. Moreover, these are the coping skills that today's students and teachers are going to need to get real use out of the equipment they've already got. These skills will become even more valuable in the future when still newer technologies emerge and these young people leave school and go searching for jobs.

I think it's time for true confessions. Confession Number 1: The emperor isn't wearing any clothes. Technology is the "emperor." And it's not a solution; it's a problem. Technology—as a problem—can come out of the closet and we can look at it as an opportunity to practice problem solving and teamwork and not whine about it when it doesn't work. It's also the perfect manipulative for young people to use to strengthen their thinking and communication skills for the future.

Next month we'll look at a strategy based on the idea of technology as a laboratory for problem solving and innovation. I have been working with teachers around the U.S. and Canada for the past year introducing this strategy in elementary, middle school, and high school classrooms. ■

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The Technology Administrator's Field of Dreams: Build It and They Will Come

I've been out visiting schools around the country, and I've noticed that we are following the same cycle of "adoptions" with the information superhighway (the Internet and so forth) that we followed with older technologies that just a few years ago were the latest and the greatest thing since sliced bread.

The basic cycle has five steps:

Step 1. You hear about it.
Step 2. You go gah-gah.
Step 3. You buy it.
Step 4. You install it.
Step 5. You wait for miracles to happen.

I call it the Field of Dreams technology plan: "Build It and They Will Come."

The notion behind this strategy is that technology is so inherently good and important that if we just acquire the boxes, build the infrastructure, or get Internet accounts for all the teachers and students, they are just going to love it. And teaching and learning will never again be the same.

Unfortunately, this is a technology enthusiast's dream world. It's a lot like the story of the engineers from an instant-camera company. These techies were infatuated with a transparent, see-through camera that showed the film being developed. They convinced their bosses that American consumers would be similarly enthused. The instant-camera company mass-produced the camera, but it flopped. Watching film develop was super-cool for engineers, but to the average consumer it was a nonevent.

A Box-Centered View of Technology

In his landmark book *Teachers and Machines,* Larry Cuban chronicled the way a small cadre of educators have embraced new technologies over the past 100 years and looked to these technologies for educational salvation. Record players, movies, radio, the telephone, TV, computers, and even the chalkboard were all at one time the subject of glowing reviews by technology evangelists.

What Cuban revealed was the technology enthusiast's "box-centric" notion of technology and our belief that smaller-cheaper-faster-better boxes can become a solution to instruction. As a group we are on the lookout for the perfect teaching machine that will deliver the benefits that automation promises, i.e., better instruction at a faster speed, lower cost, less hassle, and less sweat.

So we go out there and buy boxes. Boxes and more boxes.

"Sure, it's a nightmare today," we tell teachers, as we try installing the stuff in their real-world classrooms. "But just you wait: This stuff's the future. Before you know it, it will soon be the perfect, one-button appliance."

It feels like modern times so we forget that, as Cuban points out in his book, we have been doing this same thing over and over for almost 150 years.

Now we find ourselves employing this same thinking when we look at the new emerging technologies, including multimedia, virtual reality, telecommunications, two-way cable, video dial tones, fiber optics, digital satellite, the Internet, and wireless personal communicators.

Last night I spoke at a dinner discussion at a national conference attended by technology coordinators from the largest urban school systems in the United States. I was struck at how the discussion among these educational leaders and policymakers revolved around boxes: the cost of boxes, ways to fund the acquisition of boxes, the installation of boxes, the functionality of boxes. Frequently, I had to pinch myself. I felt as if I had taken a wrong turn in the hotel lobby and was not at a conference for educators. Instead, I felt like I was at some kind of hardware convention!

Our box-centric frame of reference for educational technology is understandable because it is a popular frame of reference for all humans vis-a-vis all machines. Unfortunately, it carries with it a couple of corollary "killer dreams" that are invisible yet crippling to many of our expensive and well-intentioned efforts to make technology usable and useful to our students and teachers. For

The notion behind the Field of Dreams strategy is that technology is so inherently good and important that all teachers and students are just going to love it. And teaching and learning will never again be the same.

There's a whole scoring system among box-minded educators that lets them know who's on the cutting edge and who isn't.

example, here is Dream Number 1: *A School Is on the Cutting Edge When It Has the Newest Boxes!*

This definition of the "cutting edge" was cooked up by the same people who have the bumper sticker: "He who dies with the most toys wins!" I call it the "George Jetson Treadmill," and it's speeding up faster and faster as new technologies come flooding onto the market.

Even a well-heeled school with the deepest pockets can only afford to be on the cutting edge for a day or two before a new set of products comes out that make the school's gleaming new state-of-the-art boxes look larger, more expensive, slower, and obsolete compared to the latest and greatest. While well-off districts race after this holy grail, leapfrogging over each other with each new mutation of technology, most districts in the country watch from the sidelines, scratching their heads and despairing of ever catching up.

There's a whole scoring system among box-minded educators that lets them know who's on the cutting edge and who isn't. I see it every time I present at a conference and a group of educators from the audience march up to my presentation table to size up my stockpile of "the new stuff." They nod their heads, ticking off the boxes on my table, hmm-hmming and secretly scoring me on the cutting-edge report card they carry around in their head. (Because I demonstrate "scavenged multimedia" I suspect that I don't get a lot of high marks for my hodge-podge of old video cameras, Califone record players, tape recorders, and music stands. But you never know.)

Preachers at a Tent Revival Meeting

I also see cutting-edge mania at countless education conferences in which teachers, school administrators, and technology coordinators are whipped into a feeding frenzy by vendors promising more megahertz, more RAM, and flashier plug-ins, add-ons, and other doodads under the hoods of their new machines.

At one conference I recently attended, groups of excited administrators huddled around a vendor/technology evangelist in a scene right out of a born-again tent revival meeting. Speaking in dramatic tones, arms waving, the evangelist stoked up the crowd: "This isn't just any chip!" he cried. "It's a PowerPC! And it promises twice the raw processing power of the best Pentium chip!"

"Oooooo..." crooned the administrators.

"And the chip can run all Macintosh OS programs as well as most *Windows* software."

"Aaaah..." the administrators said, nodding their heads.

"And the RISC chip promises DSP-like throughput for emerging processor-intensive applications like virtual reality, 3D modeling, and video teleconferencing."

"Hallelujah!" cried the administrators. They clapped their hands and stamped their feet. Several administrators whistled and gave each other high-fives.

Chasing the Elusive Comfort Zone

As the race continues, I'm noticing an emerging disaster among teachers, administrators, and students at overly technology-conscious schools. Schools that race to adopt new technologies are in such a rush to acquire boxes that they rarely have time to train the users of the new boxes. This has a cluster of unfortunate results. Teachers who are just starting to enter a comfort zone with the new set of boxes and equipment are knocked off their feet when suddenly a still newer set of boxes replaces the old.

Paradoxically, people are also put in a constant wait mode because they are told about a pipeline of new things coming. "Just next week...just next month...just next year," they are told, "this stuff will be obsolete, and the really cool stuff will be coming through your door." This compressed cycle of adoptions makes it extremely hard for teachers to invest their time, their emotions, and their brain power in the current set of materials since they know that a completely new set of materials and equipment is just around the corner. Pretty soon, a kind of future shock sets in. You see it in people's eyes and hear it in their voices. Teachers begin to grow numb, disinvested, and skeptical. And then change speeds up again.

Teachers, administrators, and support staff are put through more and more abbreviated inservices to bring them up to speed, and in the end they become more confused than ever. New knowledge becomes old knowledge. Old knowledge becomes obsolete knowledge. If what you are learning has such a short lifespan of usefulness, why invest the energy to learn it at all? At this point a portion of the faculty begins to tune out.

And this is just the beginning. The cycle time between older products and newer products is shrinking. New technologies are heaped on older technologies. Interface and compatibility become a nightmare. The swapping process speeds up until for the average nontechie teacher, the whole picture becomes a blur. We are all at risk: As the new technologies come careening and colliding into the classroom, even the diehard technology enthusiast may become disoriented and confused. And yet the quest for the cutting edge goes on!

Next month I'll cover another dream flourishing in the technology administrator's field of dreams—Dream Number 2: *Technology Is a Solution.*) ■

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Multimedia Sandbox

Edited by Fred D'Ignazio

Restructuring With Technology: A Proposal for Student Inservices

By Fred D'Ignazio and Sharon Goth-Tew

At the Teacher Explorer Center, a national training center in East Lansing, Michigan, we have trained over 3,500 teachers, students, parents, and administrators in a one-day immersion course that uses multimedia technologies to support new teaching strategies, including cooperative learning, thematic inquiry, and whole-language publishing.

Teachers who emerge from our intense, accelerated program are thrilled by their accomplishments and proud of the multimedia essay that they and their team create in the brief six hours they spend in our center. But they are also doubtful that they could replicate the same process with students back in their classroom.

Here are some of their comments:

"It would take me years to learn enough about this stuff to teach it to my kids."

"I wouldn't know where to start."

"There's not enough time in the day to do this."

"I might do this once. But I'd be so burnt-out I'd never try it again."

"The cabling's a nightmare."

"I'd be afraid to let my kids touch this equipment for fear of breaking it."

"This multimedia is ideal for gifted and talented kids. Or maybe for kids in special-ed or industrial arts. But average kids ... no way."

"I wouldn't dare try this again unless I had an expert right by my side every step of the way."

A Sony Salvation?

All of the comments above reflect legitimate teacher concerns and fears. After all, if the teacher is expected to run the classroom, *top-down*, then multimedia is a terrifying prospect. Computers alone were frightening and intimidating. Now computers are being joined by a menagerie of other black boxes, including VCRs, TVs, camcorders, CDs and CD-ROMs, modems, LCD panels, video projectors, digitizers, scanners, and dozens of other mysterious devices that seem to roll relentlessly out of Japanese factories and into our daily lives.

But what if the teacher turned things upside down and used these new devices to experiment with new styles of teaching and new strategies for classroom learning?

What if the teacher began this restructuring process by giving students responsibility for the safety and operation of these tiny electronic boxes. What if the kids' management of these multimedia tools of learning gradually trained them to manage learning itself?

Perhaps this is the opportunity that many teachers have been looking for—the chance to evolve their classroom to a more collaborative, self-managed environment that gradually transfers vital teaching responsibilities to people they respect and trust—*their students*.

Nintendo Boot Camp

Students are ready to assume these new responsibilities—if only their teacher will give them the chance.

A generation of American students has been quietly undergoing advanced training in multimedia systems and in the multimedia transformation of knowledge.

Where is this training taking place? Not in the Persian Gulf. Not in Hollywood. Not on Madison Avenue.

Where? *In kids' bedrooms*. Our kids have spent the last five years in Nintendo Boot Camp, in the privacy of their bedrooms, dens, and family rooms. They have mastered advanced cabling skills, manipulated real-time, three-dimensional databases, and navigated through complex, multimedia simulations. And all the while we thought our kids were just playing video games.

According to Jim Dezell of IBM, the new knowledge of the 21st century will be created and communicated on multimedia computers. If this is true, then our young Nintendo jockeys are future computers' first masters, pilots, and pioneers. After all, what is a Nintendo machine, if not a primitive multimedia computer?

It's time we gave these Nintendo-trained kids the responsibility to replace the *Nintendo curriculum* with subjects that have substance, such as literature, history, art, science, mathematics, and language.

A Call for Student Inservices

An exciting, effective way to tap students' vast aptitude and training in these post-Nintendo skills is to enlist them as "trainers

of trainers" in student inservice programs organized in each school building.

For years we have created inservice programs devoted exclusively to adults. Yet adults are notoriously disabled in technology-related areas and enormously resistant to the formal acquisition of technology-related skills. Because of our fixation on adults we have almost missed the truly receptive inservicing population—*students*. Students are marvelously swift learners. And students who learn with the goal of inservicing other students learn even faster!

One Hour and Five Minutes

At the Teacher Explorer Center, we have created a remarkable, accelerated learning environment (using the tools of cooperative, self-paced, self-directed learning). As a result, adults make extraordinary progress during the workshop. They typically start the day with only a smattering of computer skills and a Pandora's box stuffed with fears and inhibitions about the tools they are expected to use. The miracle is that by the end of the day, these same adults emerge, puffing, panting, and exhausted, but clinging to a newfound joy of learning and a videotape that makes them glow with pride.

The Teacher Explorer Center's primary mission is *teacher training,* yet it has also trained hundreds of students.

We have had teams of students ranging from the second grade through seniors in high school. On its surface, the students' workshop follows the same program as the adult workshop. Except:

With the students we remove the adults' detailed workshop "cookbook" and replace it with brief, oral instructions from the instructor.

And we ask the students to create a multimedia essay that is twice the length of the adults' essay.

And we ask the students to write a script and orally narrate their script along with a musical soundtrack and dub the script and the soundtrack onto a videotape overlaying laser video segments and animated computer graphics.

And we tell the students to create the essay on subjects they are studying in their classroom.

And, last, we instructors become especially perverse and hide in our back offices and expect the students' classroom teachers to manage their student teams and deliver their multimedia productions on a deadline.

And, you know what? *They do it!* They create fabulous multimedia essays on volcanoes, space exploration, dinosaurs, Canadian geography, the American Civil War, endangered species, tropical rain forests, and dozens of other subjects.

How long does it take them to crank out their essays?

On the average, a student team (composed of seven-year-olds or high school seniors) takes about *SWAT* to create a curriculum-based multimedia essay.

(The fastest group of students was a team of sixth graders from Pinconning, Michigan that finished the entire project in an hour and five minutes.)

The average student team completes their essay in one third of the time it takes the average adult team.

And when the students cross the "finish line" and show their essay to the entire class, they aren't even breathing hard.

So we turn them loose and they compose another essay before lunch.

> What if the kids' management of these multimedia tools of learning gradually trained them to manage learning itself?

SWAT Teams of Student Trainers

Each school building can harness its students' prodigious multimedia aptitudes by identifying individual students who would like to become student trainers. District technology coordinators and curriculum directors can schedule *student inservices* to train a cadre of students who can return to their classrooms and train other students.

SWAT teams of student trainers could be "loaned" to different classrooms to perform inservices for other students. Newly trained students could train still more students. At this rate, the number of trained students would multiply geometrically.

Does the process of student inservicing ignore the teacher?

Not at all. Student inservicing gives teachers a new "gentle" way to become proficient in the new technologies. Our student workshops at the Teacher Explorer Center have demonstrated that even a teacher with no prior technology training can manage student teams who are turning out multimedia essays. And as teachers work with the students, they gradually acquire technical skills at a pace that makes them feel comfortable.

Teacher-to-teacher inservicing can now be replaced—or at least supplemented—by *student-to-teacher* inservicing. This inservicing is what the experts refer to as "just in time learning." It is deeply embedded in the curriculum. It occurs while the teacher is on the job. It doesn't remove a teacher from the classroom. And it doesn't require the district to spend scarce resources on teacher substitutes.

Multimedia Clubs

Student-to-teacher inservicing is an amazingly fast way to bring teachers up to speed with new technologies. In Jefferson County, Alabama, we began a loose-knit student inservicing program based on *multimedia clubs* organized after hours by teacher and parent volunteers. The multimedia clubs were an instant hit with students and soon produced dozens of highly trained student trainers who returned to their "daytime" jobs to train other students and, eventually, other teachers.

A federal study team from the U.S. Congress visited the Alabama teachers a year after the multimedia clubs had started and found that the small cadre of 25 teachers who had been inserviced via standard workshops had blossomed to an amazing 125 multimedia enthusiasts who were so evangelical that they drafted homemade bumper stickers that proclaimed, *"Stop Teacher Burn Out. Start a Multimedia Classroom."* And they carried home computers, camcorders, and VCRs on weekends and held *multimedia slumber parties* to create lessons Monday morning on pronouns, prefixes, and the Pythagorean Theorem.

Restructuring Classroom Learning

The strategy of tapping students' multimedia literacies through student inservicing is a practical technique to accelerate the integration of technology into the daily curriculum. It is also a surefire method to *restructure classroom learning* in a manner that motivates students and is guided by teachers. It dramatically increases student participation in classroom lessons and gives teachers wonderful opportunities for personal and professional growth.

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Language and Conversation in Multimedia Storytelling

It will soon become a trivial process to assemble a *multimedia collage* on just about any subject in the curriculum. A student or teacher will be able to impress their audience by pointing and clicking on random elements of this collage *and give the appearance of "meaning" by a concentrated, intense saturation of the audience's senses.*

Today, books, words, and written and oral language are under attack. It is not hard to imagine a future in which students demonstrate learning by draining all *narrative* from their knowledge "proofs" and "performances" and instead rely on multimedia fireworks—gorgeous spectacles of images, sounds, dramatic words, and music that touch the hearts and dazzle the minds of their classmates and teacher.

Just reenacting dramatic events from the real world doesn't necessarily translate into understanding them. Through the artful use of multimedia, students may soon be able to feel like Confederate foot soldiers marching up dusty roads toward Pennsylvania under a hot sun in late June of 1863. But does this experience alone help them truly understand the Civil War?

What we need now, more than ever, are strategies for *enriching* the linguistic process of thinking by blending language and multimedia together. Language should remain the foundation, the bedrock for thinking. It can be sharpened and focused through well-placed images, sounds, and "virtual experiences" that ground students and teachers alike in their bodies and in the real world. Multimedia can help students and teachers test the relevancy of their knowledge by asking:

- "Are these words and ideas practical and useful to kids right now?"
- "How can they help kids understand the world they live in?"
- "How can they help kids make better decisions, solve problems they face, and communicate successfully with those around them?"

Multimedia, ultimately, must be a catalyst for language. It must inspire language. It must provoke debate, disagreement, discussion, and spawn even more language. What follows are some preliminary thoughts about how we can retain language, conversation, and storytelling at the heart of students' demonstrations of their understanding.

What we need now, more than ever, are strategies for enriching the linguistic process of thinking by blending language and multimedia together. Language should remain the foundation, the bedrock for thinking.

Tell a Story, Build a Model

Teacher alert! Teacher alert! Classroom storytelling is about to be transformed. In the future, storytelling will no longer be a one-way experience, active for the author/performer and passive for the audience/consumers. Nor will the only vehicle for stories be words.

However, even in the future, storytelling, at its heart, will continue to be a modeling process. In a model, the storyteller uses a short, vivid narrative to describe something interesting that happened to someone at some time. Through language, the storyteller models the original event. To be interesting to the listeners, the person in the model must remind them of themselves and therefore be universal or generic, at least in the context of the group.

Stories as Building Blocks

Most stories are told as part of the give-and-take flow of conversation. First, one person tells a story (relates a brief anecdote). Then the listeners respond with stories of their own. The conversation flows back and forth, linked by common elements in each story which spark memories of similar experiences in the other members of the group.

This is true human storytelling. Strung together over time like pearls on the thread of a necklace, the stories create a conversation. The conversation makes storytelling

an interactive, mutual, and above all, a social experience.

Natural storytelling in daily life does not exist as a one-way event. A rapid-fire "explosion" of stories by several authors characterize a good conversation. Over the course of a conversation, these stories naturally combine into a *story-conversation*.

In the future, students will be able to create a story-conversation using multimedia computers. Their stories can model some real or imagined experience of living, breathing human beings (or humanlike beings) to "grab" the attention of other human beings. But to be interactive, the stories must spark questions and curiosity in other people. They must also offer the *listeners* an opportunity to continue constructing the story-conversation by sharing stories of their own. Often, the new stories turn out to focus on details, fragments, or minutiae of the preceding person's story. But if they deal with real people and real experiences, the group welcomes them as building blocks in the story-conversation.

Classroom storytelling is about to be transformed. In the future, storytelling will no longer be a one-way experience, active for the author/performer and passive for the audience/ consumers. Nor will the only vehicle for stories be words

Even Words Can Be Experiences Without Meaning

When we use words to tell a story, we are creating a narrative. If the words are vivid and the narrative gripping, we can easily forget that the words are triggers for our imagination to experience the *virtual reality* the words describe, and that we are not experiencing the reality itself. This "suspension of disbelief," of course, is at the heart of good storytelling in any medium.

The danger is that through words or through multimedia we are experiencing knowledge, but we are not linking it to language in an active way that requires us to digest, discuss, and debate what we are experiencing. How can we translate our experience into a form that allows us to articulate our personal understanding to ourselves and to others?

One test for meaning: What does the little voice inside our head say after a great experience wrought by words, multimedia, or the real world? Is the voice reeling off hypotheses, questions, and explanations, or is it mute? Does the experience generate language or does it leave us tongue-tied? Experiences that remain unexamined, unarticulated, and undefended can hardly produce meaning.

Can There Be Meaning Without Conversation?

Multimedia may not be language, but it can be an environment in which language takes place. Teachers can challenge students to use oral and written language to react, think, and make sense of the collage of images, sounds, and simulated experiences called up on the multimedia "stage." And they must help students use language to tell stories, build models, and ask questions, and then use multimedia to invite others into this same inquiry, and build a true story-conversation.

A conversation in which only one person talks is not true conversation. Eventually, a person's listeners lose interest and either feign interest for social reasons, or their minds or bodies wander off. Similarly, it is vital for a student multimedia storyteller to provide *entry points* into the conversation for other people. The easiest way to accomplish this is for students to build space into their stories for quick text-based annotations. This could take the form of electronic "sticky-tabs" that allow people to paste their own comments or mini-stories onto the original story as they "read" it electronically.

Another method is to allow users to shape the direction of the story by "zooming in" on particular details of the story that are of particular interest to them. A third technique is to "branch" the story into different outcomes and allow the reader to choose the story's "next step" that is most appealing or tantalizing to them.

Still another method for making a story interactive is to "publish" it as a combined live and prerecorded event, much in the way TV and concerts now combine real, live performers with materials and performers who have been prerecorded. In the same way, students might create multimedia stories that were co-delivered by the students and their media and meant to be paused at several points to give students in the room an opportunity to participate or share stories of their own. Stories might also be crafted to pause each time they evoked responses from other people in the room.

Another way in which a good storyteller makes a story interactive is to stimulate listeners to predict or "extrapolate" where the story is headed. This is, of course, the art of the good mystery writer or suspense moviemaker. As you listen to the story, you can't help guessing what will happen next... and next ... and next.

This engagement of the *predicting element* of the human mind may be the most powerful tool of all. If students are really trying to create a story-conversation that genuinely engages another person, it is essential for them to set up an *anxious pattern* in their listeners' minds that each listener feels compelled to resolve.

Successful strategies for instilling such a pattern include:

1. Engage a listener's attention early.
2. Model a real human in the thick of a real predicament.
3. Feed the listener clues regarding the character's fate. Both you and the listener know that some of these clues are deliberately misleading.
4. Keep the listener hanging. (Internally they are predicting an outcome to your tale, but you let

the tension build by not telling them what happens next.)

The famed *Carmen Sandiego* series by Brøderbund Software is an example of this kind of interactive storytelling. Student storytellers could make good use of a similar strategy. They could deliver the mystery up front, then allow their listener to wade through a series of clues that might help them reach a solution. This approach seems to work whether there is a real solution or no solution. Either way, the same anxious pattern emerges in the listeners' minds, and more than anything else they want to reach closure.

The Importance of Oral and Written Language

All of students' multimedia stories should begin with a writing experience. It is critical for students to be able to use language as a building block for thinking and communication and as a planning tool to create a meaningful story or context in which to embed their multimedia materials.

Students can begin publishing their own story by constructing a "grabber" multimedia clip that acts as the anchor or core idea for development of the story. The grabber reflects the student's understanding of the story that they've gained from research and conversation. It also spotlights the crucial moment when something dramatic intervenes in a person's life to make this story worth telling.

Student research teams can use their "grabber clip" as a window or gateway that allows "listeners" to enter into the world of the persons being studied and step through a dramatic incident in their lives from a personal "swear you are there" perspective. The incident they portray grows out of a particular real-life problem—an event they experienced, or decision they had to make. The research and writing the student teams do up front acts as a bridge that carries their listeners back and forth between the experiential world of multimedia and an analytical world manipulated through language and thought. Language acts as a glue that students can use to assemble their research materials—including images, sounds, and spoken and written words—into a coherent structure. Their story becomes a tentative explanation of what they think really happened.

How to Begin

Students might begin the multimedia storytelling process by first listening to a summary of a topic by the teacher and a description of the importance of the topic. Second, students view a powerful multimedia ("grabber") clip selected for them by the teacher. Third, the teacher works with students to translate their audiovisual experience into written and oral language using outlining, brainstorming, and cluster writing exercises. Fourth, they test these ideas and expand them by linking them to multimedia illustrations pulled from various sources, which might include live interviews on audio tapes, live video created by the children, cable-TV, live distance-learning satellite connections, videotapes, videodiscs, CD-ROM, or messages and materials gleaned from online networks.

Next, the students must integrate their multimedia materials into a coherent story that demonstrates that the materials have personal meaning to the authors. Last, the students must incorporate the story-conversation techniques suggested above to use their story as an invitation for listeners to create and share stories of their own.

Modeling The World

I think the greatest use of language is as a quick and dirty tool for modeling the real world. Each time we tell a story, we "float" a new model. Even in business and technical conversations, the most persuasive use of language is in the form of models. As models are launched by different persons in a conversation, we automatically compare and contrast them, and real meaning and understanding emerges.

As we move to more sophisticated computer-based modeling tools, we shouldn't underestimate the power of language as our quickest, easiest modeling tool. When students begin using multimedia, it is not enough to throw them into a sensory sea of images, movies, music, and animations. They should first create rough-draft text models of what they are looking for in the sea. Then, they should voice these models aloud in discussion and debate. The word-based models can help students isolate their questions and focus on the areas of the model that hold the greatest interest. Last, they can translate their text-based models into multimedia stories that offer hooks, doorways, and entry points to invite other learners to comment on the students' model, reshape it, or create new models of their own. And they should begin building the new models *out of language first.* ■

(My thanks to my friend Jon Madian, President of Humanities Software, for inspiring many of the ideas in this month's column.)

[Fred D'Ignazio, Multimedia Classrooms, Inc., 4121 Okemos Rd., Ste. 24, Okemos, MI 48864.]

The predicting element of the human mind may be the most powerful tool of all. If students are really trying to create a story-conversation that genuinely engages another person, then it is essential for them to set up an anxious pattern in their listeners' minds.

Teachers' Jobs: Opportunities for Change and Growth

by Fred D'Ignazio

Technology may help you do your job better. It won't necessarily make it easier or more secure.

Although many teachers are unaware of it, they are now standing in a fork in the road. They will not be able to stand still in this fork. In one or two years they will be rushing down one road or another, even if they try to stand still and avoid change at all cost.

In this month's column, I will start a new series that focuses primarily on teachers' jobs. It is my conviction that the same changes that are occurring in the workplace in other non-educational jobs will begin hitting education in the next two to five years. Teachers who anticipate these changes have a choice: if they remain in their current roles, there is a strong possibility they will be at-risk in an environment in which machines can provide higher student-achievement outcomes than flesh-and-blood teachers for a fraction of the cost. On the other hand, this is also a time of great opportunity for teachers who yearn to grow and who welcome new ways in which they can serve and enrich the lives of young people.

In this month's column we will focus primarily on the negative path: automation and the real threat that it represents to a teacher's job. Next we will shift gears and in future columns we will look at several exciting strategies teachers can use to prepare themselves for the dramatically altered workplace of the near future.

Has Anyone Seen George Jetson?

Shoshonna Zuboff of the Harvard Business School in her *In the Age of the Smart Machine: The Future of Work and Power* (Basic Books, 1990) has concluded that the workplace is in a profound transition. Whether you are a teacher, factory worker, lawyer, retail clerk, or whatever, your job is about to change. The magnitude of this change will be enormous; the direction will be unexpected. Most of us are still looking forward to a relaxed "George Jetson" future in which our jobs are less complicated, more fun and stimulating, higher paying, and guarantee us a shorter work week.

Does This Look Like YOUR Job?

The "George Jetson" future is unlikely to ever happen. Instead we are stuck with "in your face" jobs that will constantly reshape themselves like Silly Putty, even as they become more challenging, more complicated, and, perhaps, not as high paying.

What is at the heart of this surprising change of fortunes in the workplace? Technology—chiefly information technology and communications technology. Far from creating a push-button workplace in which our humble servant (technology) tamely obeys our every whim, technology is more like a demon unchained, a Pandora's Box that is unleashing staggering forces into our daily lives that can turn our workplace into a stressful environment of chaos, unpredictability, and constant change.

And it's only just begun. New technologies will enter our lives at an accelerating pace, spurred on by lower equipment prices, shrinking sizes, and new applications that enable "tiny tech" to embed itself in every crack and crevice of our lives. As a result, it is almost certain that within our lifetime technology will never become a tame "appliance" that will make our work less burdensome and more convenient. Instead, it will be more like a storm, a blizzard, a tornado, or all the above. For better or worse, technology is our habitat, and it is up to us to develop new methods to sink or swim through this new, tumultuous environment.

Automation: 100-Student Classrooms

Technology will take two chief forms as it comes rushing into our workplace. Its older form, "automation," is still very visible in all industries and all jobs. Automation is omnipresent and a little hard to describe, but you are sensing automation if you are feeling a little insecure about your future. Basically, automation is the replacement of human labor by machine labor. As computers get faster, smarter, cheaper, and smaller, they will take over more and more low-level human tasks. It's likely that by the time you recognize your job is being computerized or automated, it will be too late. Computers will seldom enter your workplace through the front door. Instead, they will be built into the "woodwork"—the infrastructure, capital plant, the floors, the walls, the ceilings, and the furniture of new buildings and retrofitted older buildings.

Ironically, teachers who have been excitedly expecting technology to deliver a George Jetson salvation are the most at-risk in the automated workplace of the near future. They are on the look-out for a "teaching machine" appliance that will plug into a wall outlet, have one or two push-button controls, and help them do their job. Teachers who narrowly define their job as delivering the curriculum and getting students to score at or above average on standardized tests are most in jeopardy. They had better dust off their resume and check out a copy of *What Color Is My Parachute?* at the local library. Their jobs are in danger of being automated. New computerized ILS's—integrated learning systems—are getting ever more effective in accomplishing basic "teacher" tasks. And they can achieve the same or higher results as a flesh-and-blood teacher at less cost per student and a much higher class size. In fact it will soon be common to create classrooms with over 100 students "meeting" for a class period in which textbooks and workbooks have been replaced by computer terminals and the teacher has been replaced with one or two lower paid para-professionals (who may even

be upper-grade student interns). Superintendents are very aware that the biggest chunk of their school budget goes to teacher salaries, and in a time of shrinking budgets, there is huge pressure on school boards and administrators to provide equal or greater quality (translation: higher test scores) while at the same time sharply reducing operating costs.

The "kicker" is that students also favor the ILS solution. Students have no problem in an ILS classroom with 100 or more classmates if they get extensive computer time each day. The newest ILS programs feature a multimedia interface with digitized sound, music, animations, graphics, video, and speech-recognition. The irony is that in an ILS classroom, learning becomes far more interactive and engaging than it ever was in a traditional classroom led by a real human teacher.

A Looking-Glass Window

The harsh truth is that teachers who are hopeful for a teaching "appliance" that makes their lives easier will not be disappointed. In fact, their job will be simplified to the point at which it becomes no job at all. Automation already has a beachhead in the American classroom and the economics and technology breakthroughs we now face will guarantee that entire school buildings and districts will soon become far more automated than they are today.

However, automation is only half of the technology picture. Equally important is a new phenomenon known as "informating." Informating (a term coined by Zuboff, the French, and others) is the flip side of automating. In extensive case studies involving companies in all industries, Zuboff has observed how information and communication technologies have created an almost magical "looking glass" into an organization's core, which is available to even the most low-paid, front line workers out on the street, on the factory floor, and in the deepest company trenches. Integrated, networked computer systems become windows and portals displaying what Zuboff calls a new kind of scrolling "supertext" that is the cyberspace reflection of every detail in an organization's daily existence.

According to Zuboff, the personality of an organization is reflected in the way it reacts to this new looking-glass window. Many organizations are accustomed to giving their supervisors and managers exclusive "viewing privileges" into the organization's raw, unedited inner workings. In this type of culture, these managers feel highly threatened when they realize that some low-level "Joe Blow" at a computer terminal could now theoretically be figuring out the way the organization operates. As a result, they immediately close these supertext windows, make them opaque and password-protect them so only the VIPs in the organization have privileged access.

Zuboff is sympathetic with the organizations and their managers in this type of situation, but she predicts that organizations that respond in this way (i.e., "automation" but no "informating") are dooming themselves. They are forcing the small managerial class to shoulder the load of all decision-making in a radically changing, information-overkill environment. And they are reducing the contribution of the remaining employees to "point-and-click" responses which often lower morale and raise employees' hostility, resentment, and suspicion. She likens this response to a brain that voluntarily shuts down some of its main lobes to consolidate its remaining brain power in a few centralized locations.

Informating: The Light in a Tunnel with No End

A cover story in a recent issue of *Fortune* magazine focused on "Post-Heroic Leadership" in many organizations in which the managers voluntarily pull themselves off the pedestal and share the power with their employees. This is one of the key elements of an "informated" organization. As information technology weaves its way into every aspect of an organization's daily life, all jobs will change. In an informated organization, all employees will have access to all aspects of the organization's functioning. Everyone will share responsibility equally for the organization's failure or success.

Is your job more at risk if your district automates or informates? The truth is, whether your school building or district informates or automates, technology will reduce the total number of jobs. Your job is at risk either way. That is why, right now, teachers who heed this call must take stock of where they are, what skills they have already acquired, and what their goals are for the remainder of their career.

Teachers, you are smack dab in the fork in the road. No matter which direction you go, your job will be less secure in the near future. Either way, it is time for you to focus on your own bottom line. It is time to start nurturing yourself—time to upgrade your own skills and your own qualifications. Your own personal growth is no longer a whimsical luxury—it is an immediate necessity.

Uh-oh! The floodgates are open. Soon you will be carried down one path or the other. You must make a choice soon or the choice will be made for you.

Stay tuned. In the coming issues we will look at some wonderful tips to help you make up your mind.

The good news: your window of decision is still open.

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The Classroom as Knowledge Theme Park

by Fred D'Ignazio

Portfolios are more than a way of assessing learning. They are tools for transforming students into teachers.

Howard Gardner in his book, *UnSchooled Minds: How Children Think* (BasicBooks, 1991), envisions classrooms in the future in which children create multimedia exhibits to demonstrate their understanding of different curricular topics.

"Show What You Know" can be a basic methodology for students who have access to multimedia research, composition, and publishing tools. Students create multimedia book reports, biographies, math story problems, and science projects. They store their "works" on audio tapes, videotapes, and computer diskettes. If the classroom is on a central computer network, the students' work is stored on a building "server" computer and shared with students in other classrooms. Each student gets the opportunity to exhibit their work in a public exhibition on a rotating, periodic basis (let's say, once a month). Their knowledge demo resides on one of the classroom's audio cassette players, VCRs, computers, or the like. This assortment of low-cost knowledge players could be scavenged from the library media center, from children's homes, or donated by businesses or the PTA.

The classroom resembles an art gallery or hands-on science museum that always has a variety of exhibits on display. The different exhibits are loosely linked by a common curricular theme. They rotate frequently as the class as a whole journeys into new curricular areas and as different students' work is displayed.

There is probably a limit to the number of *knowledge players* that the teacher and her kids could scavenge. Therefore, it would be helpful to organize students into teams. The teams collectively produce a single exhibit. They are responsible for designing the exhibit, getting the permission of the teacher to produce the exhibit, exhibit production, and exhibit set-up, troubleshooting, maintenance, and clean-up.

The exhibits are launched or debut every couple of weeks. Guests at the exhibit debut include parents, other teachers and students, the school principal(s), district officials, school board members, local business people, and so on. Having their work featured publicly is a great incentive for student teams to work hard and create the best exhibits possible.

Many of the exhibits tie the curriculum topic (e.g., presidents, the environment, Spanish, fractions, etc.) to research the students did in the school, the neighborhood, or the community. Members of the community who participated in the exhibits' creation should be invited to the public exhibitions—for example, local health officials, firefighters, recycling organizers, librarians, museum officials, plant foremen, radio DJs, senior citizens, and so on. The community's attendance at and participation in these public exhibitions of student work build crucial support for the teacher's innovative learning design and link classroom projects with real people and real issues in the world outside the classroom doors.

Electronic Portfolios

There is a lot of talk these days in educational circles about "authentic assessment" and student portfolios. This concept of students' work being collected and used as part of a student's grade works well with the classroom as a collection of ongoing student multimedia exhibits.

Many programs that support student portfolios have been implemented using print materials alone. However, most experts agree that in the future knowledge will be transmitted via electronic non-print means. Therefore, it is important for students' portfolios to contain some or most of the students' work in an electronic format.

What kinds of electronic portfolios might students create? There are a variety of low-cost opportunities. At the beginning of the school year, a teacher sends a form home to parents requesting a contribution for class-wide purchase of one (or all) of the following portfolio "containers":

- A blank audio cassette (approximately 50 cents).
- A blank videotape (approximately $3.00).
- A blank computer diskette formatted to run on a classroom, library, or computer lab computer (approximately $1.00).

During the year, as a student works with other student exhibition teams to create multimedia exhibits, the student stores his or her individual work on the appropriate storage medium (disk, cassette, or videotape). In addition, when each exhibit is finally created, it is "dubbed" onto each of the team members' portfolio containers. An interactive version of the exhibit could be loaded onto diskette. A video version could be loaded onto videotape.

And the audio from the exhibit could be dubbed onto the audio cassette.

Gradually, the students' portfolio containers fill up with their accumulated individual and group work, creating an impressive presentation of their projects and accomplishments from an entire school year. Since each team exhibit features a different area of the curriculum, a student's entire portfolio should be varied, diverse, and cross-curricular. At least the videotape and the audio cassette (and possibly the computer diskette) can be carried home periodically to demonstrate in a private exhibition to a student's parents, family, and friends. This keeps parents current with their child's academic progress even if they are unable to physically attend one or more of the public exhibitions.

Interactive Kiosks

What would the students' exhibits look like?

The form and content of each exhibit should be limited only by the availability of inexpensive materials and the students' imaginations. During the year, students could create a variety of exhibits, some complex and some extremely simple.

What shape might the exhibits take? For example:

- A VCR and TV monitor with a "how-to" Guide Book or laminated poster explaining the purpose and operation of the exhibit.
- An audio cassette player with how-to materials.
- A computer running the students' disk-based exhibit with how-to materials.
- Any combination of the above.

Each exhibit would try to achieve the status of a standalone, interactive *kiosk.* A kiosk is an information booth. Originally, a kiosk had one or more people inside it who could be asked questions related to travel, store purchases, or directions inside a building or public facility. Kiosks also might contain informational materials, including newspapers, magazines, guide books, and brochures.

Today, electronic kiosks are popping up all over the world, playing the role of people-based kiosks of the past. An electronic kiosk usually will have a colorful screen that mixes computer graphics and stored video segments. People can ask the kiosk questions by typing on a keyboard attached to the kiosk or by pressing on buttons or "hot spots" on the computer's touch screen. Many kiosks have printers inside their display case and will print out a hard copy of information for people to take with them.

Student Kiosks

Students' *knowledge kiosks* could be modeled after other electronic kiosks, chiefly those found in hands-on science museums, zoos, airports, and theme parks.

The chief criteria for judging a student kiosk should be:

- *Ease of Use*—A hallmark of well-designed kiosks is their user-friendliness. A person can go up to a good kiosk and not need detailed instructions or training to be able to use the kiosk and get the information they need. A recipe of instructions for using the kiosk should be short, simple, and easy to read. It might be contained, in audio form, at the beginning of an audio cassette; in video form, at the beginning of the videotape; or as a simple menu of buttons on the first screen the user sees on a computer-based exhibit. It can also be a one-page printed recipe that sits beside the exhibit on a table or hangs behind the exhibit on the wall.
- *Interactivity*—A well-designed kiosk makes the user part of an active conversation. Few people will enjoy a kiosk that simply talks at them. Most people will respond well to a kiosk that asks them questions, challenges them with little puzzles, mysteries, or riddles, and feeds them information that is interesting and in short chunks.
- *Accuracy*—A kiosk is a source of information on topics that presumably new or unfamiliar to the average user. It is essential that all the facts loaded into the kiosk and embedded into its presentation be accurate and doubly checked. Student teams who create kiosks should appoint a couple of students as fact checkers to verify that the information they recite (orally into an audio kiosk), picture (visually in a videotape kiosk), or write (in a graphics and text-based computer kiosk) be current and correct.
- *Professionalism*—Even the most glitzy electronic kiosk will look shabby and amateurish if basic rules of presentation are not followed, including: good punctuation and a simple writing style; spell checking; grammar checking; large graphics and easy-to-read text; simple, elegant, uncluttered screens; short, simple video segments shot on a tripod; good, even volume for all music and sound; and spoken segments that are easy to understand. A professionally produced kiosk that only contains one minute of informative materials (written, spoken, videotaped, or accessed through computer onscreen menus) is far superior to a "hodge-podge" kiosk that rambles on and on with globs of undigested information that is boring or obscure.
- *Legality and Responsibility*—A well-designed student kiosk minimizes the use of outside, copyrighted materials. The more the students incorporate copyrighted materials the greater the risk of legal infringement on others' intellectual property rights and the temptation to use other people's creativity and thinking in place of their own.

When students use their own original (spoken, written, graphics, and video) materials to produce a kiosk, they have the opportunity to create an entirely fresh look and feel that is not imitative or derivative of any other production seen by the kiosk's users.

- Students can use their own voices to narrate all spoken parts.
- Students can sing the background music from original student compositions.
- Students can use musical keyboards and regular acoustic instruments to create background music.
- Students can shoot their own original video materials, paint their own computer graphics (or scan in original student artwork in other media such as watercolors), and take microphones and cassette recorders onto street corners and to rivers and train stations to record their own original sounds.
- Students can choose from a wide variety of low-cost *clip* media that is flooding the market (public domain music, sounds, clip-art, clip-video, etc.) to enrich their own original presentations.

If students choose to use copyrighted materials from books, videotapes, audio tapes, compact discs, or computer disks (and CD-ROMs), they should use them sparingly and selectively, and they should create *multimedia footnotes* and *multimedia bibliographies* to give proper credit to the copyright holders and creative talents who own the works.

Students' multimedia credits for copyrighted materials can take a variety of imaginative, playful, and fun forms, including:

- Pop-up text buttons on the computer screen.
- Audio credits with sound effects and dramatic fanfare on audio kiosks.
- Student-created credit screens on computer kiosks.

• Animated credits on videotape.

How to Begin

Does the idea of setting up student-created knowledge kiosks and coordinating the creation of student electronic portfolios intrigue you? Does it also overwhelm you? These ideas may excite you, but you can't help thinking about things such as:

- How to manage student teams.
- How to scavenge the equipment.
- How to set up the whole operation.
- Where to find the time in your daily classroom schedule.

These are real concerns. Therefore, the best place to start is to consult with your library media specialist and with a small group of fellow faculty members who might share your enthusiasm for these ideas. Many schools have successfully launched *electronic portfolio* programs and *knowledge kiosk* programs, but they usually don't begin the programs in the classrooms. Rather, they usually choose the library media center as the launch pad for innovation and exploration. The media center is a perfect place for experimentation and prototyping. Then when a workable model is up and running, teachers can choose to "import" a manageable version of the model back into the classrooms for classroom implementation.

A Recipe for Success

A 12-step model to use the library media center to launch portfolio and kiosk programs in the classroom is outlined below:

Step One—Form an instructional team composed of teachers, the library media specialist, the principal (or curriculum director), and the computer coordinator.

Step Two—Form a kiosk-design team composed of students chosen from one or more classrooms and/or grades. The students must have certain skills, including interest in and/or aptitude for using media, good social skills, including ability to cooperate and compromise; ability to share, nurture, and coach; ability to lead or work as part of a team on a collaborative project.

Step Three—Set up an after-hours multimedia club. The club will be composed of the teacher team and the student team. The purpose of the club will be to talk about the electronic kiosk and portfolio projects and to begin planning the first couple steps. The club meets in the library media center.

Step Four—Design two or three prototype kiosks. Keep it simple! Don't get too ambitious! Make the first kiosks simple, easy, short, and doable! Stick with a simple computer slide show, a short audio cassette, or a 15-second "PSA" (Public Service Announcement) videotape.

Step Five—Scavenge equipment and set up two or three electronic kiosks (a VCR and TV; or an audio cassette player; or a computer and color monitor).

Step Six—Produce simple programs for the kiosks. Test the kiosks among the teachers and students in the club. Make the entire effort highly collaborative and experimental. Have everyone take turns demonstrating and showing off the kiosks. Pretend you are a parent, a school board member, or another student who has never used the kiosk. Ask yourself: would the person find the kiosk interesting? Informative? Easy to use? If not, how can you improve your design?

Step Seven—Organize an Open House in the Library Media Center. Set up the kiosks and do your first public exhibition. Create a short survey form to get public feedback on the kiosks.

Step Eight—Take the kiosk(s) on the road. Put them on low, safe, wheeled carts that students can safely push around the building (on one floor only!). Let the students present the kiosks in classrooms as "visiting teachers" who use the kiosk as a multimedia audio-visual chalkboard. Gauge student and teacher reactions to the students, their presentation, and the effectiveness of the kiosk. Invite students in each class to use the kiosk.

Step Nine—Set up the kiosks back in the media center for classes to use when they visit the library media center. Have short "suggestions" forms beside the kiosks to encourage student and faculty feedback.

Step Ten—Train classes on kiosk design. Work with original teachers who participated in the program. Have them create assignments in which students visit the library, create kiosks during library periods, and roll the finished kiosks back to the classroom for classroom presentations and daily or week-long exhibitions.

Step Eleven—On a teacher-by-teacher basis, experiment with loaning the kiosks to the classroom for in-classroom production of kiosk exhibitions.

Step Twelve—Scavenge enough equipment to create one or two pilot classroom kiosks for teachers willing to keep kiosks in the classroom for ongoing creation of new kiosk programs and ongoing kiosk exhibitions.

Continued on page 50

```
  LET f = SIN(x)
  SOUND 1200 + 1000 * f, 0.05
  PLOT x, f
NEXT x
END
```

When you run this program, you will see that the graph wiggles, as shown in Figure 3. The sound wiggles, too. It goes up , then down, then up, just like the graph. See what you hear and hear what you see.

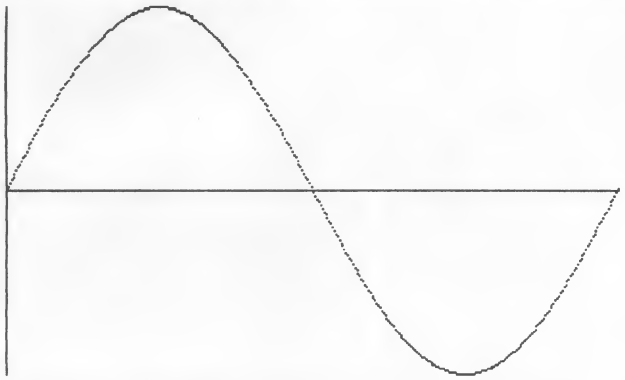

Figure 3. Sine (SIN) graph and sound by Zappy Artist.

Here is one more program. Before you run it, figure out what it does.

```
! Wiggly Mystery Program by Zappy Artist
CLEAR
SET MODE "GRAPHICS"
RANDOMIZE
SET WINDOW 0, 360, -1, 1      ! Coordinate system
PLOT LINES: 0, 0; 360, 0      ! x-axis
PLOT LINES: 0, -1; 0, 1       ! f-axis
OPTION ANGLE DEGREES
LET k = 1
DO
  SET COLOR IP(15 * RND) + 1
  FOR x = 0 TO 360
    LET f = SIN(k * x)
    SOUND 1200 + 1000 * f, 0.05
    PLOT x, f
  NEXT x
  LET k = k + 1
LOOP
END
```

That concludes our exploration of *True BASIC* and our visits with Zappy Artist. Next time, we'll show you some new spreadsheet applications that we are using in math and science at C-TEC.

DragonSmoke

Teaching BASIC to Kids is our sharebook (free site license) that covers and compares *GW-BASIC*, *QBasic*, and *True BASIC*. Since *GW-BASIC* is rapidly disappearing from the real world, we will phase out *GW-BASIC* and phase in a little *Visual Basic*. We have shrunk the first 32 pages to one-fourth size and pasted them on eight pages—four shrunken pages to one 8.5" by 11" page. To get the first 32 shrunken pages of *Teaching BASIC to Kids*, send a self-addressed, stamped envelope to Teaching BASIC to Kids at the address below. We'll also throw in a bibliography of *Visual Basic* books and tell you how to get an inexpensive disk that contains 100+ *True BASIC* programs and 100+ *QBasic* programs.

Bob Albrecht and George Firedrake, P.O. Box 1635, Sebastopol, CA 95473-1635.

Continued from page 37

Conclusion

This concludes my four-article series on the appropriate uses of multimedia technology for learning. If you have enjoyed this series, or you have questions regarding the ideas in the articles, please contact me at the address below (Fax me at 517/349-3657. AppleLink me at: f.dignazio. Or E-mail me via Internet at: dignazio@msu.com).

It has been a real pleasure to write these articles. I hope you have gotten some ideas you can use in your media center or classroom.

We are entering an exciting era that will reward educators who experiment with new electronic teaching materials. However, there are so many opportunities that your choices for experimentation and innovation are mind-boggling and almost overwhelming. Therefore, the important thing is for you to think collaboratively and hook up with like-minded teachers and student assistants. When you jump in, be prepared to make mistakes and take wrong turns just like any real explorer or pioneer blazing a trail into an uncharted land. And when you, your fellow faculty members, and your students begin your journey together, remember to have fun and keep it simple! Pioneers pace themselves so they can live to pioneer another day!

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Index to Advertisers

The Active Media Center

by Fred D'Ignazio

School libraries and media centers are changing from warehouses to launch pads. And the countdown has already started.

This article is part of a four-part series that began two months ago. The articles are cumulative in their discussion of concepts and paradigms, so it would be helpful for you to see each article as a part of a larger "conversation" framed by the entire series. (Translation: If you haven't read the first two articles, go out there and find them!)

Spigot Meisters of Multimedia Learning

The first two articles focused on practical strategies for classroom teachers. Unfortunately, as we all know, teachers are known for doing all kinds of innovative things in their classroom that somehow never spread beyond the classroom walls. A few "high fliers" in every building always manage to scavenge resources (money, supplies, "Moms," the principal's blessing, etc.) and do wonderful things. Other teachers typically feel a combination of admiration, wonder, and, sadly, resentment. And the world of the school building, after feeling a bump or a ripple, pretty much remains the same.

What is needed is a schoolwide strategy for change. If multimedia is all that it's made out to be in the popular press, at educational conferences, in vendors' ads and presentations, and in the first two articles in this series, then it ought to be a tool for promoting schoolwide change.

Many school administrators recognize the power of multimedia technologies. Unfortunately, they *still* see technology in its old "George Jetson" role as "automation." In order to "automate" the classroom, administrators convince district voters to pass multimillion-dollar bonds to install new "hard technology architectures" in district classrooms—fiber optic cabling, TVs in every classroom, video, voice, and data networks, classroom computers, publishing centers, language labs, and so forth.

According to this way of thinking, the goal is to transform the entire school building into a "learning appliance." The teacher becomes the instructional-spigot operator. Teacher training consists of learning how to operate the spigot to spray videos, sounds, computer data, and so forth into the classroom. The teacher's key professional responsibility is to decide when it is appropriate to turn the spigot on, how long the spigot can spurt "learning" into the room, and when it should be shut off.

In this mechanical metaphor, the library media center becomes the "switchboard" for receiving the new knowledge and curriculum materials, and the library media specialist becomes a "super" spigot operator (a spigot "czar") who opens the main pipes to the various classrooms and decides what media materials to squirt into each.

Is "Nuking the Kids" the Answer?

As more research on learning, teaching, and good schools appears, we are discovering that "instruction" and "learning" cannot simply be "delivered." But try to tell that to school administrators and vendors promising "turn key" solutions to all of schools' educational woes.

According to the "paradigm" for technology prevalent in schools today, in the school of the future, kids will simply arrive, take off their coats and hats, and "plug" themselves into a building-wide learning appliance. And they will love it!

We know our kids love TV. We know kids like to work at computers. But is this the true classroom of the future? Is this preparing kids for an age of "disposable workers" and "throw-away workers?" Does it match the latest research we have in active learning and new teaching practices? Will it give our children the essentials to hold down a job or be a responsible citizen in the 21st century? Does it even vaguely compare to the transformation of the workplace in which fewer workers are required to engage in "high-performance teams" to solve problems in less time, with less money, and use computers actively as budget-crunching, problem-solving tools?

And what role does this assign teachers? It's fine to move beyond the current model of the teacher as "Sage on the Stage" to "Guide from the Side." Unfortunately, instructional delivery systems will soon be so multisensory, so entertaining, and so engaging that the guide from the side may eventually become the "Boor out the Door!"

We all know that teachers need to grow into new roles. But there is no need to make these roles "deskilled" and "dehumanized" roles. Teachers should not be replaced by machines at the center of the learning process. The moment of learning should still be human centered. It should still be part of collaboration, conversation, and competition among humans.

Schools need to move beyond the deceptive simplicity of the instructional-delivery model. Finding ways to introduce more and more media into the classroom with push-button ease is ultimately more harmful than good. Instead, schools should look to ways to put teachers and students at the steering wheel to manage the "appropriate" use of media for active learning. Media can cost a lot and look high-tech, but it might still produce passive students and passive, devalued, and resentful teachers.

This does not need to happen. A little common-sense thinking up front can help steer your school along a better, brighter path.

Classrooms in the future, in order to model the outside world, need to become media "construction" centers rather than media "consumption" centers. If learning is viewed as a full-time obligation for teachers and students alike, and if learning is seen as the active construction of meaning by any human being, then we need to look at media not as "knowledge" or "curriculum" but as raw ma-

terials to help learners construct their own meaning in rich and diverse ways.

Informating vs. Automating

Astute observers of the workplace such as Shoshonna Zuboff of the Harvard Business School have observed that corporations that are going through the throes of restructuring are learning how to "informate" rather than "automate" their workplace. Automating, according to Zuboff, is just the transfer to machines of current tasks and procedures. The result is to speed up the current process (with fewer people and at a lower cost) but not to change that process in any fundamental way.

For most companies, just in order to survive, this is not enough. Most companies are now transforming the entire way they do business. They are remaking their companies from the ground up, and in the process, they are changing the jobs of everyone in the organization from the lowest worker to the company president.

"Informating" a workplace results in dramatic fundamental change in the way companies see their product, their customers, and themselves. Informating a workplace means to use computer and communication technologies to enable all workers to become intimately familiar with how the company works—"in real time"—and to play a vital collaborative role in improving the quality of every operation in that company. Informating happens when a company goes from a "paper-time" world of days and weeks lagging after a job arrives to moving to "real-time" operations with "just-in-time" solutions to complex problems the moment they arrive.

Schools are preparing our country's citizens and workers of the future. In order to be a legitimate provider of the preparation and training, they need to be aware of the world outside the classroom door; schools need to move beyond "automating" to "informating." Learning, teaching, and construction of meaning can not be "automated." They must be "informated." Teachers and students must learn to see themselves as knowledge workers who use the best tools available to construct meaning out of their emerging world. Construction of meaning must occur constantly and actively in "real time"—not in a "paper time" world that existed in textbooks or work sheets a decade or even a year ago. Students who learn the world as it is represented in a paper-time *past will emerge* with a knowledge base that is hopefully outdated. Students who are taught older methods of knowledge acquisition and assimilation will find themselves lacking valuable job skills when they emerge from the artificial "paper time" world of the typical classroom.

If we are to "informate" our classrooms rather than "automate" them, we must look at all media—books, worksheets, magazines, television, videodiscs, CD-ROM, and so forth as "active media"—raw materials for the collaborative and individual construction of knowledge. Such a strategy can not be accomplished in one or two classrooms while the rest of a school building is going about business in the normal way. Such a strategy must begin as a building-wide initiative. And it can start in the school's library media center.

A Launchpad for School Change

Educators who are interested in using technology to promote serious school change should focus first on the library media center. The library media center is "ground zero" for a new school of the future that sparks teachers and children to engage in the constant, furious construction of knowledge.

But in order for the library media center to be an agent for change, it must adopt the new paradigm of "active media." Viewing the library through the old metaphor of a "treasure" or "collection" of media will not prepare the media specialist for his or her new role. Neither is it healthy to look at the library media center as some kind of mechanical "switchboard" for routing, regulating, and controlling the media pipelines that fan out to a building's classrooms.

Authors, Not Eaters

Media in a school of the future should not be something you "consume," it should be something you *author*. The gigantic influx of new knowledge that is ready to flood into the schools along the new national data "superhighways" should be chunked, diced, and sliced by students into raw materials for their own construction projects—their own multimedia book reports, research projects, digital movies, scientific experiments, simulations, multimedia prototypes, and springboards for classroom debate, analysis, and discussion.

This real-time construction of meaning out of diverse raw materials and fragments bombarding the school from the outside world is *precisely* what students will need to master to succeed in the outside world.

The Library as Media Construction Center

The library media center must rethink its role. Gone are the days when a student can come into the library armed only with a pen or pencil and a stack of three-by-five index cards. In such a library, the student is inadequately prepared in five critical dimensions:

1. The Library Must Equip Students to do Multimedia Research.

Index cards and pencils can only be used to capture text-based knowledge. They are woefully inadequate as research tools to research and capture the emergent representations of knowledge in the form of images, sounds, movies, animations, and human voices. For example, students doing a report on Martin Luther King, Jr. need to leave the library of the future with selections of Dr. King's dramatic speeches—actual recorded sounds! They need to leave with moving images of Dr. King's passionate orations and emotional pleas for a peaceful transformation to a new kind of equitable society. They need to leave with maps, diagrams, and charts that trace the path of Dr. King's life and the violent turmoil of the times in which he lived.

What tools can they use to capture these rich multimedia sources? They are digitizers, scanners, cameras, and recorders, microphones, headphones, graphics tablets, VCRs, musical keyboards, and paint programs. Whatever they are, whatever they will be, student researchers should learn how to use these tools in the library. And the library should be the place where they gain their first experiences putting these tools to work.

2. Libraries Should Become Sites for Instant "Real-Time" Authoring.

Today's print-based text (letters, numbers) will be replaced by a "supertext" of the future that includes images, sounds, diagrams, music, voices, and movies. Students shouldn't go to the library of the future merely to browse through this supertext and perhaps capture examples of it. Instead, they need to learn how to become instant, real-time authors of supertext.

Libraries should think seriously about fusing their facilities with school computer labs. Library media specialists and computer coordinators should rethink the way they use their computers—their "multimedia research stations" and "multimedia authoring stations" as part of a schoolwide initiative to promote student multimedia authoring and exploration.

Imagine a room that houses a library's print collection next door to a "research and publishing" room that houses the library's multimedia workstations. Students could come and go freely between the two rooms, gathering materials equally from electronic online

sources (Internet, computer data services, Cable TV, CD-ROM, videodiscs, etc.) and from the print-based sources in the library.

The object of the students' work would be to work together as collaborative authoring teams to merge and meld information they dig up in all formats into their own original narratives. What is more, these narratives should first be word-based. They should be created with the new generation of multimedia-embedded word processors. The words are constructed in the center of the page and the multimedia icons, hot spots, and triggers are added around the edges, as annotations, and as colored boxes around the words.

The process of multimedia composition might be termed "illumination" (based on IBM's popular *Illuminated Books and Manuscripts* program). "Illumination" starts with students authoring their own words or capturing words from books and magazines by scanning them with a simple hand scanner (like Logitech's ScanMan) and using an optical-character recognition (OCR) program such as *CatchWord Pro* to transfer the words into a common word processor.

The ScanMan, *CatchWord Pro,* and the new generation of multimedia word processors (such as WINGS for learning's *MediaText*) can transform the library's print collection from a remote, dusty "closet" of words into a rich treasure trove of words that can be translated into multimedia format, then illuminated with images, music, movies, and students' own oral narrations.

3. Libraries Must Offer Students Daily, Real-Time, Real-World Publishing Opportunities.

Students' old research and writing tools gave them the opportunity to create "throwaway" projects destined for the teacher's folder, the student's backpack, or maybe the family refrigerator. This is a publishing dead end and the students know it.

Students have little incentive to "show what they know" when it is obvious from the start that their audience will probably be only themselves, their teacher, or maybe Mom or Dad.

Libraries must give students an opportunity to publish to a larger audience. They can do this today using online, real-time methods to electronically publish their works. It's sad but true: For most students, print publishing is a black hole. Print documents can only realistically be shared by a few people. On the other hand, if students are able to publish their works electronically, they can be copied and communicated instantly, digitally, and circulated locally and globally in a matter of minutes.

Who would ever want to "read" stuff created by kids? No one in today's hierarchical paradigm that regards student works as "practice" drafts for their real, adult works of tomorrow. In a world filled with passive students using media passively, publishing is a peripheral, ancillary "afterthought." Students are not expected to do work that is truly original or that transcends the work of the teacher. So they don't.

But if you switch to an "active media" paradigm, then you see that it is possible for students to be creating materials that *have never existed anywhere*! If you accept that we are on the threshold of a new age of digital electronic knowledge—of instant, real-time communication and work in "virtual" offices and classrooms—then students are the first generation of authors who can create truly new works and prototypes using these new media formats. Students are, in fact, best suited to be truly experimental with the new media and to work to transform knowledge in its current print-based format into multimedia constructions of the future.

And they need an audience. To get that audience, they will need to go beyond media glitz and pizzazz, since media moguls in Hollywood, Tokyo, and Silicon Valley will create multimedia productions that wow and dazzle the senses and the mind. Student productions should be more serious than that. They should concentrate on issues, concerns, themes, and topics that they encounter every day inside and outside the classroom. Student multimedia publishing can be instructionally focused on environmental issues facing a community, on homeless people, on health insurance, on parenting and family lives, on making better decisions about money, nutrition, substance abuse, and sexuality. These are issues that are already on every student's mind but which are frequently unarticulated, undigested, and amorphous. They are also issues that could make student authors' work interesting and entertaining to other students down the hall or around the world. Productions on these issues would also be informative and instructive to parents, to local businesses, to public agencies—to everyday citizens in the students' own community.

We have the opportunity to make every classroom a "classroom without walls." Every classroom may soon have access to a "video dial tone" that links your students with students in St. Petersburg, Singapore, Beijing, or Caracas, Venezuela. Student researchers can use new multimedia "index cards" including video cameras, tape recorders, and notebook computers to become real-world researchers to see things with their own eyes, hear things with their own ears, and tell their story with their own voice. They can take raw materials they gather in their community and mix them into a larger brew of electronic and print-based materials that they have assembled in their library media center.

The incentive for students to work their hardest and do their very best work and meet deadlines is that they will have an electronic publishing "window" back out to the real world—to other students in other classrooms, to parents, their community, the news media, and government agencies. With the new multimedia interactive cable channels coming (500-1,500 channels in the next two years), a library can become a "broadcasting studio" that can send students' interactive works over the wires to any place in the world for the cost of a phone call.

And student "publishing" in "real time" will be a compressed two-way street rather than the formal, plodding one-way publishing it was in the paper-time past. When students "publish" their work, it will become the first statement in a "conversation" in which people react to the students' work and reply. The replies can occur in the form of people in their homes keying in replies over cable-TV keypads. They can come in the form of business leaders in the Rotary meeting or Chamber of Commerce replying live in a two-way video teleconference with the students in the classroom. They can come from world leaders, from students around the globe as real-time discussion or in the form of "quick-and-dirty" multimedia productions. Publishing in the future using dynamic media will come to mean a mutual conversation—a process—rather than the output of a static, unchangeable product than an author "writes" and a reader (sometime in the future) can only "read."

4. Libraries Must Become a Hub for Inservicing Students in New Tools for Exploring and Sharing Knowledge.

Based on the discussion in the two earlier articles, you can see that it is not enough to turn the students into multimedia authors, researchers, and explorers.

Students in today's schools are an unrecognized source of new-media literacy and competence. Unfortunately, the only evidence most teachers see of this is students' devotion to violent, trivial video games, or to couch-potato consumption of electronic media in the form of Walkmen, CD players, and MTV.

Students could become a pool of trainers, troubleshooters, and consultants who could

fan out into a school building as a webwork of support for the set-up and operation of new-media tools in every classroom. But it would be a disaster to just assign them this job and turn them loose. Students would almost certainly be poorly prepared for such an important responsibility. The problem is that few of today's students have been given the trust and responsibility to manage their schedules, nurture and coach other learners, operate as courteous, respectful, and helpful consultants, give their "all" in the solution of tricky technology problems, or act maturely in a group that fosters fair and spirited discussion, group problem-solving, and task-completion.

The library media center could be the training ground for a new kind of student of the future—a student that must emerge to prepare for tomorrow's problems and for needs troubling today's schools. A library media center could sponsor a series of "Student Inservices" all year long in which students learn how to work together as high-performance "SWAT" teams who could be launched, at a moment's notice, to any part of the building to do some "just-in-time" training, set up equipment, or save a teacher from a technology black hole. These student "glitch-busters" and "teacher savers" can be trained to make teachers look good and feel good about themselves and about the munchkins who come into their room to help them out.

The Student Inservices could be conducted after-hours as a "Multimedia Club." This would take the pressure off the library media specialist to manage the club during regular library hours. The student club could help the library media specialist preview software and new media, and help set up new equipment. The library media specialist could train the students with the help of a "Teacher Explorer" team of teachers who were interested in seeing the students take on responsibility for helping teachers and other students around the school. The technical training of students would go hand-in-hand with the group-process training that prepared the students to be effective coaches, teacher helpers, and technicians around the school.

To test the club's effectiveness in training a cadre of student consultants, the media specialist could begin inviting teachers to club meetings. The teachers would be the "guinea pigs" for student consultants. The teachers would be "off the clock" and not in front of a classroom of kids with curriculum deadlines, buzzers, and bells to stress them or distract them. They could give feedback to the students on how effective they were encouraging them to take their first hesitant steps into new areas. Rotating several faculty members through the club in this role on afternoons over a semester would expose the building's teachers to a new role for students and would help prepare them for students to visit them as consultants, student coaches, and troubleshooters. It would help teachers evolve comfortably into a new role in which they didn't know everything—and weren't afraid to show it! It would help them see how they could still guide and inspire students even as they discovered that they, too, could become excited and enthusiastic learners.

Over time, the student inservicing would gradually blend with teacher inservicing and teacher-student inservicing. This process would be gradual and would maintain a high comfort zone for teachers and students alike. At the end, there would be a cadre—a critical mass—of non-age-specific "teacher explorers" available to the school. The adults would see how they could still be teachers but would also see themselves as learners and explorers. The young people would get into the habit of active, fast-paced exploration, problem-solving, and learning, but would also begin to see themselves as "teachers" who had the responsibility to share what they had learned with teachers around the building and with their fellow students.

The impact of this strategy on a school will be enormous:

- A growing webwork of students will act as a "safety net" to support ongoing schoolwide experimentation with a boggling array of new technologies.
- Students will gain just the sort of skills experts say they will need in tomorrow's world, including: communication skills, problem-solving skills, skills using new technologies to think with and as tools, group process skills, teaming skills, coaching, nurturing, planning, managing, and training skills.
- Teachers will gain a growing cadre of students who will be respectful, courteous, and genuinely helpful. These students will gradually impact on the school culture and "rub off" on other students who can then become ready recruits into a growing network of student "construction crews," "SWAT teams," and trainer/coaches.

The whole process will unleash the vast yet invisible reservoir of "trapped" brainpower that is latent in today's classrooms, and will enormously accelerate both the classroom learning process and a school's ability to digest and productively use new technology tools as soon as they are affordable and available for daily use.

5. A Library Has to See Itself as a "Human Communications Center."

It is self-limiting in the real-time, online electronic world of tomorrow to think of a library media center as a "center" for stuff.

As library collections evolve from print-based materials to more abstract electronic representations of knowledge that are only transitory and "in transit," it will become foolish to think of a media center specialist as a person who has to "manage" a collection of media. The media will actually reside in the media center less and less. Instead it will be in the process of being "input" into the center, massaged, researched, and digested by hordes of student authors and investigators, then "output" to classrooms around the building, around the district, and to other sites around the world.

Think of the library media center as a Grand Central Station of Knowledge. Students and teachers will rush through this busy, noisy hub catching trains of knowledge as they whisk into the station, then reconfiguring and rebuilding these trains and riding and sending them, lickety-split, back out of the station.

The real value in the library media center will not even be the knowledge itself but the ongoing human-to-human communication that it spawns. Thus, the library media center should remake itself as a "communications center."

Knowledge itself will become a more fluid, compressed, interactive, conversational substance than it is today. It really looks more like "communication" than the traditional stacks of print-based symbols that have to be unlocked by a single learner plodding tediously, page after page.

Knowledge in the future will be multisensory, sharable, modifiable, revisable, instantly published, joined, and divided—just like a fast-paced intellectually stimulating conversation!

The media center will launch important new conversations that students and teachers can take back to the classroom where they can be added to and enriched by further conversations that spark everyone to make their voices heard.

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Beyond Multimedia: The Student As Sherlock Holmes

By Fred D'Ignazio

Paradigms Lost: The Search for a George Jetson Future

Our schools are gearing up in a noble quest for "the holy Grail" of technology: a perfect system that will deliver instruction, work smoothly with little need for training or maintenance, and not require replacing at least for five to 10 years.

NOT!

Unfortunately, most schools are creating technology plans, passing bonds, getting grants, and implementing technology based on an unworkable paradigm—a George Jetson paradigm dating from the 1930s in which we see technology as a gleaming white appliance that saves us labor and promises us convenience, reliability, stability, and push-button ease of operation.

Technology as "teaching machine." Technology as instructional delivery system. Perfect. Reliable. Simple.

Think about it. You are probably right now installing a new computer network, training teachers on how to use a laserdisc player, setting up a CD-ROM drive on the computer in your library media center, negotiating with the local cable TV company to wire your classrooms with educational cable channels, or something else.

Right? And what do you think will be the end result of all your labors?

Are you hoping that "one golden day" your work will be done? Are you hoping that all these systems will be installed? That the wires and cables will all be laid? The plugs all plugged in? The machines all turned on? Software installed? The machines all up and working—as faithful servants of energetic and happy teachers and students?

Uh-oh. You had better think again. You are a victim of the "George Jetson Syndrome." You see your technology infrastructure as some vast, interrelated system (read: "appliance") that can somehow be plugged in, turned on, and made operational, stable, and unchanging—just like some kind of educational refrigerator or toaster oven.

Unfortunately, technology has undergone a fundamental change—from an "automating" phenomenon (a labor-saving and labor-replacing device) to an "informating" phenomenon. Technology at the local and global levels now is no longer our guardian angel. It is our demon! Technology contributes more to the changes, the complexity, and the turmoil of everyday life far more than it is responsible for making our lives easier.

And it is only going to get worse.

In the next five years (even before the 21st century!) all forms of information, communication, and media technologies will converge, collide, fuse, and combine in "silly-putty" configurations that generate hybrid products that are unleashed on the consumer and educational markets.

In the past few years, we have realized that "computers" are not synonymous with "technology." We have realized that the instructional-technology toolkit for teachers should be drastically broadened to include new tools such as cable TV, fiber optics, satellite TV, computer modems and networks, distance learning, multimedia, video production, compact disc, laserdiscs, VCRs, fax machines, cellular phones, portable computers, etc.

This is only the tip of the iceberg. In the next five years as industries get plopped into a digital Cuisinart, the old products will be sliced, diced, pureed, and blended into new products whose shapes we can barely imagine. The first wave of new "multi-function" technology products that reflect digitally blended industries are now on the horizon: the new PDAs—the programmable digital assistants. Little "handtop" computers that marry the functions of a clipboard, memo pad, telephone, file cabinet, fax machine, E-mail, and typewriter. But these machines are only the beginning.

The result is that the real changes in educational technology are ahead of us—not behind us. So if you are trying to stabilize your district's technology picture and install the ultimate, George Jetson, one-button appliance, forget it. The real educational technology breakthroughs are yet to come. And they are right around the corner.

Onto the Rollercoaster

It is time for educators and businesses alike to adopt a new paradigm for managing educational technology, and education, in general. If we insist upon adopting and installing technology as an appliance, then we are doomed to frustration and failure. It's a game that we cannot win. As soon as we think we have a handle on the rapidly evolving clusters of new technologies, they will metamorphose—right before our very eyes—and become a new set of products. And if we've bet on the old products, we will be grinding our teeth because we will have spent our money, and we won't be able to purchase the new vastly improved mix of products that will cost a tenth of what the old products cost—only two or three months ago!

Before we despair or begin thinking of new career alternatives, stop and think it over. We

can take pleasure in two facts about our dilemma. First, we are all in this together—business, industry, government, consumers, and educators all are on board the technology roller coaster together. We are all victims of this mammoth technological transformation, and we are all poised to take advantage of some of the fantastic opportunities that the new emerging technologies will provide. Second, we have no choice but to climb aboard this roller coaster.

Think about it: Do you really have a choice? The world outside the classroom is jumping on board the technology bandwagon. If schools are to model that world and provide a context for young people to cope with that world and develop strategies for survival and success, then it is imperative for schools to provide a technology-rich environment for teachers and students. Everywhere else, students will be immersed in this "sea" of tiny digital electronic technologies. The same must happen in the classroom. Or we are committing a terrible fraud if we claim that we are preparing our children for tomorrow's world.

The New Paradigm: Technology as Process—not Product

The new strategy for technology is to see all machines, all equipment, all manuals, all software, etc. as process not product. Our job as technology-using educators will be redefined from trying to install the perfect technology infrastructure to providing the perfect process of constant technology exposure, experience, and challenges to teachers and young people. That's our new job, our mission, our basic job responsibility. We need to keep acquiring new technologies and putting them in students' hands so they can train seriously for the jobs, the world, and the lives they will lead tomorrow.

The idea is for the classroom and the district to become "open systems" rather than closed, stable, and isolated "instructional delivery spaces" that we conceived them to be in the past. The idea is to work backwards: what are some important developments in the outside world that will soon affect our smaller world inside the classroom?

What are the emerging technology clusters that promise to be "mainstream" for at least the next five to 10 years?

The answer here might be something like: voice, video, and data networking, interpersonal computing, workgroups, multimedia E-Mail, CD-ROMS as a probably "super disc" that will soon carry all knowledge, all information.

Second, what are the emerging careers that are spawned as companies and governments restructure, flatten their organizations, automate, collapse, and "informate" older jobs into fewer, newer jobs? What cluster of skills must our high-school graduates have who enter these jobs? What types of post-high-school training will be essential for students to land the best high-paying jobs (or even the lowest level jobs that keep them from becoming disposable "throwaway" workers)?

What sort of curriculum should we be implementing that will give our young people something more than the almost meaningless pieces of paper that their high-school and college diplomas have become, once they are a year or two past school and out struggling to survive in the work world?

The Key to Success: The Student

The new "keys" will not be paper at all. They will be carried inside the heads of our students as they emerge from school. They will be a cluster of quickly-proven performance skills that students will have to demonstrate in performance tests that companies will use to match them to emerging positions in their organizations.

How can students acquire these skills? How can we modify students' roles in our schools to help us cope with the new paradigm for technology as "process" and not product?

A Practical Decision: Enlist Your Students

Our first and most important step should be a source of relief to every teacher, technology coordinator, and administrator because it is so easy. Help is at hand; in fact, it's standing right in front of you now, in every classroom, in every school building, and computer lab. It's your students.

It's time for you to take a break from your toil. You are in a backbreaking, hard-driving rat race to understand and implement new technologies. You are in a rat race in your classrooms to learn these new technologies yourselves, integrate them into your curriculum, and somehow teach 30 to 150 students a day how to use these technologies.

Then you wake up in a month or a year. The technologies have all changed, and you have to go through the process all over again. Is there any surprise that you feel resentful, gypped—that somehow you have been told a "lie"?

You can't do this. And if you try, you will burn out, max out, and become a casualty rather than a leader, or even a survivor. Very frankly: your job is on the line.

So take a small, common-sense step in the other direction: Enlist your students in the process of teaching, learning, and managing this high-tech classroom of the future.

Learning Webworks: The Twilight of the Guru

The era of the "guru" has past. It is physically impossible for todays teachers to stay current with their field and to somehow "pipe" all that new knowledge into their students. Knowledge is exploding too fast and in too many formats for you to keep up. Even if you are a "print" literate teacher, you are still missing most new areas in your field that are being communicated over university computer networks, television channels, CD-ROM databases, bulletin boards, E-Mail systems, and videodiscs. Just trying to scan all these sources (much less get your hands on them) would take you 24 hours a day. And you still couldn't keep current.

It is also physically impossible for one or two technology coordinators to somehow keep abreast with the lightning-fast pace of new instructional technologies and somehow purchase them, install them, and integrate them into every classroom in every building with every student and teacher. Every teacher knows how hard it is to get technical support "just in time" when you are up against the wall, facing a group of kids, and the stuff doesn't work. By the time you stretch one or two technology coordinators so thin to get them in every classroom that needs a technical facilitator you have reduced the quality of support to near zero—even for the most dedicated and talented individuals. And our teachers and students deserve more support—far more.

So don't even try. Instead, look to the future in which you can swap your isolated and lonely teacher-guru and technology-guru role for a role in which you build a webwork of student-gurus—a classroom full of coaches, technology aides, polite and respectful consultants, mini-lecturers, gophers, and explorers who can collectively and collaboratively help you perform two important tasks:

1. Get the most out of the best new technologies that you can get into your classroom.
2. Help every student in your classroom have the most access to these technologies, use them to learn new knowledge in all its forms, and communicate and share that knowledge at each individual's maximum possible rate.

Conclusion: The Student as Sherlock Holmes

Technology is not a system, it's an endlessly challenging box of mind puzzles and mind-twisters.

Technology is food. It is sustenance for children's minds. Students need to "feed" off new technologies—the same kinds of emerging technologies that they face outside the classroom doors and in the jobs they will occupy as they enter the work force.

The only way for this to happen in your classroom is to swallow your pride, put a grin on your face, and get out of your kids' way. Transform your kids from a weight to a webwork of support for everything you undertake. Take the terrible, impossible burden of "know-it-all" off your poor adult shoulders and become a new kind of taskmaster—equally demanding, equally essential to the kids' educational experience. Your job is now to transform your kids from a room of semi-engaged, smirking loiterers into a irrepressible group of Sherlock Holmeses. Your job is to set up a classroom culture that values individuals, values discussion, communication, politeness, consideration. A culture that spurs innovation, questioning, experimentation, investigation, and hard work.

Into this classroom you "plop" down an endless stream of new technologies. It doesn't matter how much they cost, or which technologies they are, just so you keep feeding the kids with new stuff, new challenges.

You tell the kids they must somehow figure these technologies out so they can get down to the real business of using the technologies as tools to get at all the new forms of knowledge that are blossoming around us. You tell the kids that you are not content that one student learns anything. The only time a student gets credit for an assignment is when he or she coaches a fellow student and imparts the same skill or knowledge to them. Your goal is to create a bubbling brew of problem-solving and inquiry. Your job is to create a buzzing hive of learner-bees that swarms over new technologies that find their way into your classroom. These learner-bees take pride in almost vertical learning curves that allow them to install new machines and new software in the classroom, and make it functional in a single classroom period. They take pride in finding new ways to replicate their knowledge among their classmates and around the school building as roving S.W.A.T. teams of polite, professional student consultants and coaches for other teachers and other students.

Epilogue: A Student-Centered Classroom

This little essay asks you to turn your world on its head — to forget all the new technologies and instead turn your attention and your passion on your students. They are your salvation. The technologies are not important. Close your eyes and they will change. Blink and they will change again. They are transitory. Rather than see them as mobile Berlin "walls" that are rolled into your classroom, preventing you from seeing your own future, forget them. Repurpose these boxes and wires into sustenance for your students' minds. Let your students tackle the hardest, the most promising new technologies, and push your students to master these technologies. Percolate their knowledge around your classroom, and use the technologies to open new windows on content, on your curriculum, and your lessons that you never dreamed possible.

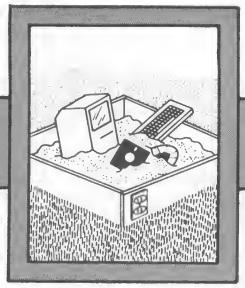
Think of your classroom as a laboratory for thinking. Your students are your thinkers. Turn your students loose as thinking and problem-solving teams. And the grist for their thinking is technology. Let them digest the technology, solve its problems, make it work, and take pride in their successes. Let them use the technology to connect your classroom to all the new knowledge that you and they can possibly experience.

You will be making a sane career decision —a decision that will help you survive and become a leader in the classroom of the future. And you will be making an honest effort to prepare your students for the terrible challenges they face now and will soon face as adults.

Next month we'll look at how to use the library media center as a resource area for your young Sherlock Holmes. The classroom teacher can work on process and content in her room (and keep multimedia to a manageable level). And the library media center can become an escape valve for multimedia energies—a "Grand Central Station," or hub, for students' collaborative multimedia research and publishing activities.

[Fred D'Ignazio, Multimedia Classrooms, Inc., 4121 Okemos Rd., Ste. 24, Okemos, MI 48864.]

Editors' Note: This is the second of four "Beyond Multimedia" articles. Earlier versions of these articles appeared in the University of Central Florida's *Connections* magazine.



Multimedia Sandbox

Edited by Fred D'Ignazio

Multimedia Training Centers: The Highest Tech At Affordable Prices

By
Fred D'Ignazio

Multimedia's Price Tag

Multimedia is the hottest new technology in schools. Unfortunately, multimedia is awfully expensive!

Schools used to worry about finding the funds to purchase computers, but computers are only part of the learning environment in a multimedia classroom of tomorrow. Schools wishing to set up interactive multimedia classrooms must find the money to purchase computers, VCRs, camcorders, laserdiscs, large-screen TVs, LCD panels, video projectors, scanners, digitizers, network controllers, CD-ROM players, modems, satellite dishes, cable-TV hook-ups, telephone lines, and the software to make everything run.

And don't forget the new media—the interactive multimedia software like MacroMind *Director 2.0* and Autodesk's *Animator*, and the laserdiscs and CD-ROM discs with rich curricular material. None of these products are cheap. For example ABC News Interactive's *Martin Luther King, Jr* package (which includes a two-sided 12" laserdisc plus HyperCard software) retails at $395; Compton's CD-ROM *Multimedia Encyclopedia* costs approximately $1,000; the Grolier CD-ROM *Electronic Encyclopedia* for a computer network costs $3,000.

A single multimedia learning center for a classroom can easily run between $10,000 and $15,000. Four student stations and a teacher station in a classroom may cost $35,000 or more. And a multimedia lab can cost upwards of $500,000.

Few schools will be able to afford such a high price tag. Wealthy schools will end up with magnificent multimedia classrooms, while the majority of schools will be left behind as multimedia "have-nots."

Scavenged Multimedia

One route schools can follow is to scrounge multimedia from nooks, crannies, and dusty supply closets around the school building. Schools forced to do multimedia on a shoestring can build a classroom multimedia center out of a "scavenged" low-end computer (e.g., Apple IIe, Commodore 128, Tandy 1000, or IBM PCjr), a Califone record player, a VCR, and a TV. Software for the center might start with *Slide Shop* from Scholastic or *VCR Companion* from Brøderbund. Even with the software, a few audio and video cables from Radio Shack, and a blank tape or two, costs for a scavenged center can be kept under $100.

Schools can get tremendous benefit out of scavenged multimedia. Teachers can use the center as a "presentation station" for classroom lessons. They can videotape software tutorials directly from the computer (by cabling the monitor jack on the computer to the VIDEO-IN jack on the VCR, inserting a blank videotape, and pressing RECORD). Students can create video book reports, video term papers, and video science projects by taping graphics screens off the computer onto videotape and by adding music and sound effects from the record player. (All this can be accomplished by cabling the output jack on the record player to the AUDIO-IN jack on the VCR).

If teachers put their scavenged center on wheels, they can roll it around the school! Now students in several classrooms—and in art class, music class, and the media center—can gain exposure to multimedia by sharing a single mobile center.

Scavenged multimedia offers the biggest bang for the smallest buck. Student multimedia authors can make the driest areas of the curriculum come to life through multimedia presentations that combine sounds, colorful text, music, and computer graphics. And all this can be done on equipment commonly found around most schools.

Racing into the 21st Century

Using scavenged equipment to build a multimedia center gives schools the ability to begin experimenting with multimedia today despite the limited budgets. Schools can repurpose discarded, leftover equipment to put their teachers and students on the cutting edge. Overnight they can go from projects that were "state of the past" to projects that are state-of-the-art. They can get

more use out of what they've already got. Few schools can afford to pass up this sort of opportunity.

Unfortunately, there is also a down side to scavenged multimedia. While schools are busy scavenging old record players, cassette players, TVs, VCRs, and computers, the rest of the world is racing into the 21st century. Businesses are investing heavily in high tech and acquiring the latest multimedia devices for their employees. The advances in multimedia computing are mind-boggling. If schools remain at the "scavenger" level of multimedia for too long, they will miss a revolution in communications, training, and learning of enormous proportions.

Advanced interactive multimedia is already being used to create training stations for corporate employees. It is used to conduct two-way, full-motion video conferencing among employees scattered in far-flung locations around the globe. Companies are creating multimedia "kiosks" and information centers that orient visitors, advertise new products, train new personnel, and act as sound, video, and animation front ends to corporate data bases. In corporate briefings and meetings, dry statistics and reports are being transformed via multimedia into interactive presentations composed of imagery, music, and the dramatic use of voice, graphics, and sound effects.

Multimedia is helping companies run their businesses more efficiently, train their employees, and sell more products.

It should also be used in classrooms to help students learn.

School/Business Partnerships

Schools don't have the financial resources to buy the latest high-tech equipment, especially since that equipment is changing so rapidly. However, it is possible for schools to form partnerships with businesses to gain access to the funds for new equipment.

Businesses all around the U.S. have expressed an interest in helping schools improve the quality of public education. Most businesses have been motivated by the need to train students in equipment and skills they will need for the workplace of the future. Schools can form a partnership with local business that helps them gain access to high-tech tools they otherwise could not afford. Businesses benefit by helping to train the future workforce in their local community. And they, too, gain exposure to equipment, training programs, and facilities that otherwise might not be available.

Multimedia Training Centers

Many schools already run training courses in the evenings for employees of local businesses. The courses are usually held in a school's computer lab and are run by local high-school teachers and students (acting as teachers' aides). The schools charge a fee to companies who send employees for training. The fees provide valuable financial support to help the schools maintain their current equipment and upgrade the equipment with new equipment as it becomes available.

This same concept can be applied to multimedia training and equipment. An enterprising school district can put together a plan for a new multimedia training center, and then invite representatives from local businesses to a presentation on that center. The center can be located on-site at the high school and be staffed by high-school teachers and students. As "founding sponsors" of the center, businesses will contribute the funds to help the school district acquire and install the multimedia equipment and software and train high-school personnel. In return, the businesses will be able to send employees to be trained in the center. Once their training is complete, business employees, school teachers, and students can work together to develop special multimedia presentations and training programs customized for the needs of the sponsors.

Everyone benefits. Schools get to acquire and expose their students to the latest in high tech equipment. Businesses receive good local publicity for supporting schools, and they get a chance to train their employees on equipment that is probably just as new to them.

The longer-term benefits may be even more important. Schools and businesses will have an opportunity to work on projects of joint interest. Students and teachers who visit businesses to help them with their multimedia presentations and training will acquire a first-hand knowledge of how the businesses really work. Businesses who send employees to work in schools will start to appreciate the complexities of public education. The community as a whole will benefit from the closer ties between their businesses and their schools.

[Fred D'Ignazio, 1302 Beech St., East Lansing, MI 48823.]

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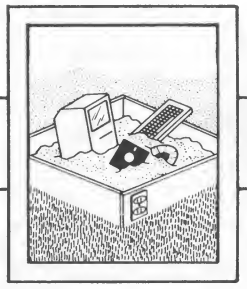

Multimedia Sandbox

Edited by Fred D'Ignazio

Restructuring Knowledge: Opportunities for Classroom Learning in the 1990s

By Fred D'Ignazio

Spaceman Spiff

My favorite *Calvin and Hobbes* strip is one that I pulled off the calendar in our kitchen at home. The strip shows Calvin as Spaceman Spiff, blasting around the galaxy, discovering a new dimension where time has no meaning. In most of the strip Spiff is in control. He is heroic. He is making life or death decisions. However, in the last panel, Calvin is no longer the spectacular Spiff. He is just a kid sitting at his desk at school. "Off camera" we hear his teacher saying, "Now we carry the one into the tens column... "

When I was young I was a "Spaceman Spiff." Now I am the father of an eleven-year-old Spaceman Spiff. In fact, we are raising a whole generation of Spaceman Spiffs. Their egos and imaginations are fed a steady fantasy diet of MTV, one-second video and sound bites, Ninja Turtles, Wrestlemania, Stephen King, Nintendo, high-powered commercials, and jazzed-up movies with computer-synthesized special effects and digital, high-fidelity surround sound.

It's a sea of electronic media out there. And our kids are submerged in the sea with their eyes, ears, minds, hearts, and imaginations wide open, swimming through the media, devouring the media, seeing themselves reflected in the media.

And then the school bell rings.

Our children scramble into school and leave the outside world behind. They close the classroom door, and the turbulent sea of images, rotating text, voices, music, and sounds disappears. The tide recedes. The sea dries up. And in its place is a tiny trickle of numbers and words—a spoken stream flowing from the mouth of the teacher and a printed stream slowly scanned on a page in a textbook.

How do kids react to being yanked from the sea, hauled from their habitat, beached like a whale on an arid shore?

Who you gonna call? Spaceman Spiff!

The Multimedia Pencil

Clearly we have a problem here. Teachers have important things to teach their students—language skills, computational skills, science, history, culture, civilization. We can't have our students tripping out just when we serve up a carefully crafted meal selected from each of the basic educational food groups.

Fortunately, help is near. In the past 10 years something new has come into the world: *tiny tech*—a blizzard of tiny, portable computers, video cameras, VCRs, cellular phones, fax machines, musical keyboards, Walkmen, and other miniature gadgets. We have mistaken most of these devices for toys, but they are not really toys at all. Instead they are multimedia pencils—harbingers of a new era in human history, an era of interactive, multi-sensory, restructured knowledge.

In past eras, what were the carriers of knowledge? The human mind, the mouth, spoken language, written language. In the world of the past, the power tools of knowledge were the pencil and the pen.

Now new pencils and pens are emerging. Video cameras, for example, are visual and auditory pens, capable of capturing real-world images and sounds from a child's own world—the real stuff of life as kids live it. New camcorders like Sony's TR5 weigh only a few ounces and fit into a kindergartner's hand. Camcorders will soon be small enough, simple enough, portable enough, and cheap enough to become children's personal thinking tools, the carriers of what children feel, think, and observe about the world around them.

Post-Desktop Fusion

There is something else out there, too. It's more than a sea of media or a blizzard of tiny tech. It's a process of rapid, accelerating confluence and convergence. All those tiny devices—the cameras, TVs, faxes, and so forth—are coming together and fusing. They are becoming something beyond computers, beyond TV, beyond telephones, beyond copying machines and other appliances that have become mundane fixtures of the adult workplace.

We are witnessing *post-desktop fusion*. It is "fusion" because computers, cameras, and other knowledge appliances are transforming themselves, combining functions, and growing smaller and smaller. The process is so quick that we can almost see it with the naked eye. It is "post-desktop" because we are swiftly moving beyond the desktop as a metaphor and as a hub for capturing, processing, and communicating knowledge.

We used to talk about "desktop computing" to reflect the fact that computers were small enough to fit on everyone's desktop. But computers have continued to shrink to post-desktop sizes—from transportable to portable, from portable to laptop, from laptop to notebook. Now we have pocket computers. And talking, wrist-top computers with built-in speech recognition and cellular faxmodems are not far away.

Dick Tracy, here we come!

The term "desktop computing" is also troublesome from the computing point of view. In a world in which microchips have burrowed their way into every appliance to make it "intelligent" and "programmable," where is the real computer? It may be the video computer that we use to capture images and sounds and that we call a "camcorder." Perhaps it is the "smart TV" or "programmable telephone" or the battery-powered portable fax copier. One thing is certain—computers are not just boxes resting on desktops. Instead they are more like caterpillars busily transforming into butterflies of startling shapes and sizes. And herein lies our opportunity for restructuring knowledge—to expand knowledge beyond a narrow stream of text and talk to a rich flood of multimedia knowledge that feeds the senses, stirs the imagination, and pierces the heart. Learners are not just little linear text computers. They are human beings with bodies, senses, and sensitivities that yearn to be tapped. It is time that we feed and nurture human beings as whole persons and let them communicate in a multitude of modalities.

Do Trash Cans Turn You On?

Where are the fresh metaphors to inspire us and help us understand a world of interactive, multi-sensory, restructured knowledge? Is the textbook an appropriate metaphor? The blackboard? The desktop?

Be honest. How appealing is the desktop for the average human being—adult or child? Do little images of trash cans and file folders really turn you on? Do they capture the power of creating interactive presentations that begin to have the "look and feel" of the real world?

Do they reflect the way "knowledge" will be captured, constructed, and transformed in the workplace of the future? The "desktop" is appropriate if your pen is made of wood and lead and you need a flat, horizontal writing surface to become an author. It is less appropriate if you can become an author with a little mobile *fusion pencil* that includes a stylus and a screen on which to write, that runs on batteries, that has a built-in video camera (or jack), a microphone, a cellular faxmodem, and stereo speakers. You can hang your "pencil" from your shoulder or pop it into your knapsack. You can take it to conduct multimedia interviews with senior citizens who actually lived through the Great Depression or the First World War; with scientists at a local college or business; city officials who are struggling with where to locate a new prison, how to dispose of solid waste, or how to preserve the habitat of an endangered animal.

You can "write" using your fusion pencil while you are at a friend's home, on the playground, on a bus, at the kitchen table, or under a tree. In a world of fusion pencils, the desktop is *the world*, and your job as a young multimedia author is to go out and capture bits and pieces of that world to share, describe, and make understandable to those around you.

Scavenging in a Gutenberg-Plus World

Using a fusion pencil, all those Spaceman Spiffs out there can put "pen to paper" and create dazzling, animated graphics, moving images, and high-fidelity sounds. They can create miniature models of the real world that come to life through the shrewd use of sounds, images, and words that engage the imagination.

They can become authors in media they now only consume.

Teachers who recognize the power of these new multimedia pencils are smart. Their students can explore restructured knowledge and do multimedia publishing—in the classroom and on a shoestring. For example, a savvy teacher can build a scavenged publishing center for her students out of the flotsam and jetsam of scuffed-up devices that kick around every school (the record players, tape players, VCRs, TVs, computers, and cameras). Teachers can be on the cutting edge by repurposing low-cost equipment they already have and by combining it into a multimedia publishing center that simulates fusion pencils of the future.

These centers tap young people's vast, latent, hidden skills in an emerging world of restructured knowledge. Children have acquired enormous navigational "literacy" skills from a lifetime of swimming through a sea of electronic multimedia. Children already know how to "read" this media. Now let's teach them how to "write" it.

And not stop there.

If a teacher is going to help her students restructure knowledge she first must ask herself: What is knowledge? If knowledge is text, then students can use word processors, animation programs, CD-ROM, and online databases to capture knowledge, organize it, and create publications. If knowledge is images, then students can capture, explore, manage, and manipulate knowledge with video cameras, laserdiscs, computer graphics, and so forth. If knowledge is sounds, then students can capture sounds with microphones, digitize sounds into the computer, and explore sounds on a tape player, Walkman, or record player. If knowledge is people's spoken words, then students can tape their own words and the stirring words of famous individuals such as Thomas Edison, Martin Luther King, Jr., and Helen Keller.

If we redefine "knowledge" as being something more than spo-

ken and written text, we move to a new definition of knowledge—not a post-Gutenberg definition but a *Gutenberg Plus* definition of knowledge. The Gutenberg Plus definition retains the high regard for written and spoken language as a tool of thought, communication, and imagination. But it also values young people's significant skills in visual and auditory literacy, in manipulating complex visual, textual, auditory, and three-dimensional models (computer games), and their experimental attitude toward mastering and troubleshooting complex multimedia equipment.

Experiments vs. Productions

Smart teachers should value these skills and assign responsibilities to students to help guide them and harness their skills to explore knowledge in new ways that would be too rich and multi-faceted for a teacher to attempt on his or her own.

Smart teachers should not feel inadequate if their students' technical skills far exceed their own. They should not feel intimidated if their students' work surpasses their work.

What type of work should students do? Not *productions*. Teachers should avoid multimedia productions like the plague.

"Production" is a word from the past—from the era of Hollywood, Madison Avenue, and Broadway. It is a term describing one-way media that is produced by producers and consumed by everyone else. A production is linear, often passive, and incapable of being altered, annotated, or repurposed by the user. A production makes someone the "producer" and everyone else the "audience."

Productions themselves can be pits. They are costly, time-consuming, and require special expertise. Productions are not practical for daily classroom learning. They are also not appropriate for the coming era of personal, interactive, restructured knowledge.

What is appropriate? How about knowledge experiments, "how-to" demonstrations, rapid prototypes, instant publishing, and throw-away multimedia databases. Students' multimedia research and publishing must be cheap, quick, dirty, and out the door to meet students' and teachers' needs. It must be conversational—students and teachers must feel free to invent, experiment, draft, test, and reshape the media on the fly.

Classroom publishing centers should not be little TV studios and publishing houses. These are models of the old media. Instead they should be messy innovation labs, inquiry centers, and impromptu spaceships that take students and teachers on low-budget, half-hour electronic field trips to explore knowledge spatially and contextually—just as it exists in the real world.

Share-A-Student

Webster defines the word "virtual" as "having the effect of being real without physically being real." Students are already part of a *virtual world* created through the old, one-way electronic media. This is the cultural "sea" that they swim through outside the classroom. However, teachers and students can also create their own virtual worlds using the new interactive media.

A *virtual classroom* in the future will have the look and feel of the real world. With the addition of low-cost telecommunication devices (faxmodems, two-way cable TV, etc.), students in physical classrooms will be able to collaborate and form virtual classrooms that span cities, states, and countries. Students will be able to participate in virtual "share-a-student," "junior-year abroad," and "foreign-exchange" programs electronically rather than physically. Teachers will help students reach out to scientists, policy makers, business leaders, writers, and artists and invite them into the classroom as virtual guests, virtual teachers, and virtual "writers in residence" for a day, a week, or a semester.

The mark of a real virtual classroom of the future is how thoroughly it engages in *local-global fusion*—the integration of the real world right outside the classroom door with events of global significance and universal impact. It is not enough just to study "the world" if that world is remote and the people in it are people you could never hope to meet yourself. Nor is it enough to study only the nearby physical world that students experience with their own senses. With the help of telecommunications and portable "fusion pencils" students can explore both worlds simultaneously to create a balanced picture that demonstrates the fragile, interlocking nature of all actions, events, and people's lives on our planet.

Memorization vs. Models in a Virtual World

In the classroom of the future, students will be able to assemble multimedia databases on their computers that have a startling, lifelike quality. The databases will have fragments of the real world: its sounds, its voices, its music, its images, its spoken and written languages—its exceedingly rich, profoundly important texture. The proof of the success of the databases will be how well they mimic and recreate reality and, equally, how well they help student authors and their classmates explain, describe, and understand the real world.

When they are successful, multimedia databases can become something more than "databases." Perhaps we need a new term to describe them. Perhaps "knowledge bases," "meaning bases," or "reality bases" is more apt.

Or how about *virtual reality*?

In the classroom of the future, students will move away from memorization of facts and become authors skilled at crafting models of the real world. These little virtual-reality databases will have the look and feel of the real world, but they will be computer based simulations that can be paused, replayed, and analyzed from a dozen different perspectives (mathematical, spatial, historical, geographical, contextual, etc.).

You might call them multimedia story problems in which students focus on the dilemmas of real people—moms, dads, scientists, explorers, and quarry foremen—as they confront life and try to make timely decisions despite too little information, too little time, and a chaos of competing distractions and alternatives.

These story problems can become the interactive presentations that students create for their classmates and challenge their classmates to solve—with the aid of the multimedia databases for research, experimentation, "what-if" speculation, and "just-in-time training."

What Does a Cab Driver Know?

The ultimate goal is for students and teachers to build their own expert systems out of multimedia databases and multimedia story problems that focus on real-world expertise, the problems real people confront, and the decisions they must make. These systems let students simulate a real decision maker operating in the real world. For example, if students were to "model" a taxi cab driver in a large metropolitan city (or their own home town!), they would start by scanning maps of the city into their computer. They would research documents and interview people in the local public roads department. They would also enlist their older friends and their parents to drive them around town while they videotaped the major arteries, intersections, and highways that crisscross the area. Last, they would interview real taxi cab drivers and listen to the way they navigated the city, paying attention to their special knowledge regarding daily traffic patterns, roads under construction, alleyways and hidden shortcuts too new or too obscure to appear on any map. Students would build all these items into a multimedia database and multimedia story problems that focused on real highway planners, real commuters, real policymakers, and real cab drivers.

But they wouldn't stop there.

Through the process of presentation, publication, and interactive class discussion, the student cab-driver team would evolve its database/story problems into a working expert system that reflected printed, analytical knowledge and knowledge that never finds its way into any textbook or any document—knowledge "mined" from the experience and practical savvy of real-world people as they go about their jobs.

The result? A real-world, multimedia expert system created entirely by students and their teacher. Such a system would be worthy of a public forum—presented over local cable or two-way interactive TV; "telepublished" via modem; or delivered live to the city council, government planners, and city officials.

Such a system would be a non-trivial task for students and teachers to dedicate themselves to. Instead of working with warmed-over knowledge and hand-me-down tools to solve toy problems, students would be immersed in the complex stuff of reality. As Judah Schwartz of Harvard says, "In the classroom of the future, knowledge will not only be transmitted, it will be *created*."

This is the type of classroom our students and teachers deserve.

This type of classroom will give every student and teacher the chance to become a Spaceman Spiff. Even better, the world they navigate and the problems they solve will not be the stuff of fantasy or dreams, but the real world seen from a thrilling variety of rich perspectives.

The challenge will be supreme. In fact, it is just the ticket we need to engage our young people in classroom learning in the 1990s. Anything less and we can be sure that part of their minds, hearts, and imaginations will soar right out the window, off to a galaxy far, far away, and we will let a precious opportunity slip through our hands.

The Teacher Explorer Center

The Michigan Department of Education has awarded a grant to East Lansing Public Schools to set up a model "classroom of tomorrow" that demonstrates the ideas above. The name of the classroom is the *Teacher Explorer Center*. The center will demonstrate how teachers can use new, integrated technologies to restructure knowledge and implement new strategies for classroom learning.

The center will host demonstrations and full-day workshops for teachers, policy makers, and community leaders, beginning in late May and ending in September. To learn more about these demonstrations and workshops, please call the Teacher Explorer Center at 517/337-1781 (ext. 58) or write Teacher Explorer Center, East Lansing Public Schools, 509 Burcham Drive, East Lansing, MI 48823.

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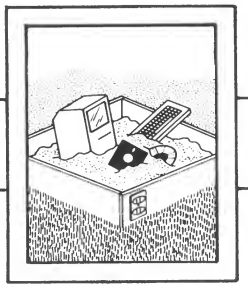
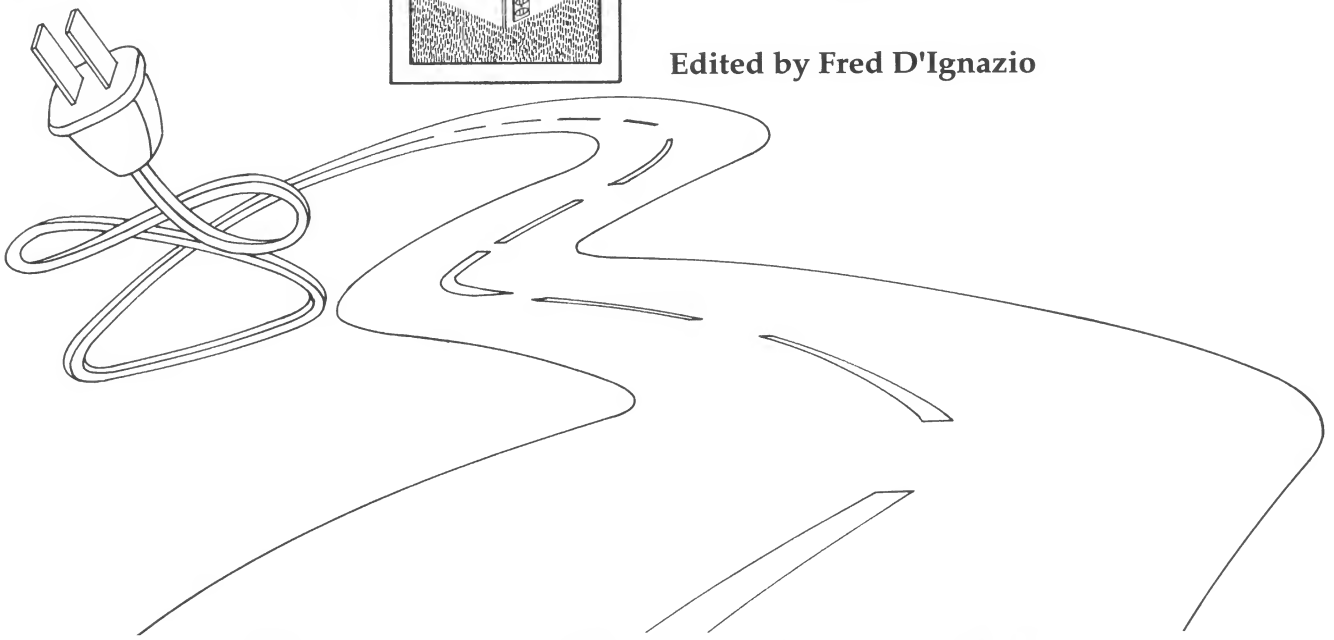


Multimedia Sandbox

Edited by Fred D'Ignazio



Electronic Highways and the Classroom of the Future

In this column we've explored the concept of *desktop fusion*. All major knowledge, information, and communication industries are converging around the digital desktop computer. New, faster, more powerful microcomputers will soon have the ability to capture, process, store, and communicate all forms of knowledge—including words, still photos, video, speeches, hi-fi music, and animations.

Planetary Fusion

Desktop fusion resembles the process of planetary formation. Many scientists believe our planets were formed from motes of dust that combined into clods. The clods combined to form boulders, the boulders combined to form still larger boulders. The mega-boulders eventually combined to form planets.

Similarly, small electronic devices are starting to combine into more complex devices. Instead of the force of gravity (and centrifugal force) we have the power of the *integrated circuit* acting to draw different devices together. Microprocessors and memory chips have become the "souls" of all kinds of communication machines, such as telephones, TVs, fax machines, and CD-ROM drives. Now we see the machines themselves beginning to combine. Video cameras and VCRs have combined to form *camcorders*. TVs and VCRs are combining to form *TVCRs*. Boom boxes now commonly carry several "on-board" information appliances, including a radio, a cassette player/recorder, a compact disc player, and a TV. Sony recently announced the "Face to Face" picture phone, consisting of a tiny TV screen and a camera attached to a telephone. Casio makes a tiny musical keyboard, the *SK-1*, that has stored sounds from real instruments and voices, and a microphone and memory chip that allow you to digitally record and store additional sounds, including your students' voices.

In the process of planetary formation, small units combine to form bigger units. Due to the miniaturization of solid-state components and electrical motors, large, heavy units are combining to form smaller units. Sony's *Video Walkman* combines a color TV screen and an 8mm VCR into a TVCR the size of a paperback novel. The *10th Anniversary Walkman* includes a stereo radio and auto-reverse cassette player that you can slip into a shirt pocket. Transportable computers have become portables. Portables have become laptops. Laptops are turning into *notebook computers* and *memo pads*. And as they shrink, they are being combined with scanners, bar code readers, and faxmodems!

Tiny tech means more features, more devices fused together on a smaller piece of electronic real estate. And it usually means better quality. The Sony player may be the size of a box of crayons, but its *Mega Bass* delivers room-sized stereo sound!

Electronic Highways

All of society's information producers are busily converting their specialized knowledge into a digital format. In addition, they are furiously constructing new channels that have the speed, capacity, and reliability to rush their knowledge to its next destination. *These channels are the electronic highways of the 21st century:*

- Communication satellites
- Fiber optic lines
- Cable TV
- Microwave transmissions
- Cellular phones
- Computer modems
- Fax machines
- Broadcast television
- Radio

Who is building these highways? Who are the users? Businesses, government agencies, and higher-education institutions. Even drug lords, spies, and terrorists are on these highways. Everyone, in fact, is a builder or a user of electronic highways—except *schools!* With a few notable exceptions, K-12 schools are *not building, using, or planning to use* the electronic highways of tomorrow.

After all, what educational purpose do these highways serve? They carry news broadcasts, scientists' research findings, academic studies, government reports, banking and financial information, people's voices, data, and images. This may be the electronic buzz of an entire planet, but how does it fit into curriculum? And even if schools saw a way to incorporate it into a teacher's lessons, how would they *capture* it? How would they *transform* it into something useful in the classroom?

Electronic Dirt Roads

This attitude reflects the prevailing orthodoxy of how knowledge enters the classroom and how that knowledge is used. It has created an odd variant of the electronic highways that might be called the *electronic dirt roads*. Some pioneering schools are aware of the importance of electronic (increasingly digital) methods of capturing and communicating knowledge. Unfortunately, most of their efforts are in developing road systems that are walled off and insulated from the highways and byways of the larger world.

Many of today's current and planned distance-learning networks consist almost entirely of professors and teachers broadcasting their lectures to students in remote locations. In many cases, the students can respond to the teacher via a two-way audio link or a two-way video link.

The names *teleclassroom* and *distance learning* have the ring of "high tech," "innovation," and "the future." But we may be using electronic methods to reinforce a teaching environment better suited to the past.

Much of the educational research of the last decade has been critical of the "frontal lecture" method of teaching. New methods of learning are being developed as supplements and alternatives to the lecture style, including cooperative learning, apprenticeship, peer teaching and peer coaching, thematic learning, community problem-solving, and inter-generational learning. In classrooms of the future, today's educational leaders see students in active, problem-solving roles, working closely with their classmates to develop a "hands-on" understanding of curriculum topics.

In this context, is a distance-learning network that features an electronic "talking head" a road into the future—or a dead end? Few in business, government, or even higher education will wish to climb aboard and ride these roads alongside us. These K-12 networks may become electronic alleyways that have no role to play in the larger network of electronic highways that will carry almost all of the new knowledge of the 21st century.

A New Paradigm for "Classroom"

How does knowledge enter the classroom? What role does the teacher play in carrying that knowledge to the student? If the paradigm for a classroom shows knowledge entering the classroom through "teachers" and through "text books," then schools will try to extend that paradigm into the electronic age. Schools will create their own electronic networks. And the only travelers along those networks will be tele-teachers and tele-textbooks.

This model of the classroom has electronic trappings, but it doesn't turn the classroom into a *vehicle* that teachers *and* students can use to travel the *real* electronic highways in order to experience new knowledge for themselves.

It is 1990, and we are on the threshold of a new century. To prepare for the new century we need to create a new paradigm for "classroom." *In the 21st century a classroom won't be a stationary, isolated room, but a vehicle capable of traveling around the world, back into time, and out into the solar system and beyond.* The tools to turn today's classrooms from stationary boxes into sleek ships for knowledge exploration are already at hand. But we will never use them until we begin dreaming boldly and start imagining a new kind of "classroom" where we might teach.

Just in Time Training

In the classroom of the 19th century, the pace of emerging knowledge and the need for retraining was slow enough to permit a "trickle-down" method of dissemination. Educational publishers could take their time, digest the highlights of new discoveries, file them into appropriate subject headings and taxonomies, and distribute them as worksheets and textbooks to thousands of classrooms. Teachers played the role of "switch-

men" on the railroad. They routed these curricular materials, slotted them into the daily schedule of their school, and paced and measured their students' progress.

As we make the final jog to the next century, things are changing rapidly. New knowledge is exploding and growing more complex. The need for training and retraining is no longer occasional, it is constant. The whole notion of training is being redefined from an alternative track that a worker enters only once or twice a year to "on-demand" training and "just-in-time" training in which a worker receives training almost continuously, in order to cope with a constantly changing work environment. If the workplace changes from week to week, then a worker needs training in small, customized bites, right on the job, rather than on weeklong sabbaticals to special "training classrooms."

And what does the worker's workplace look like? It has real people. But there are also more and more machines whose job it is to take the worker to all the *virtual people* with whom he or she does business. Webster's dictionary defines "virtual" as not physically real but having the effect of being real. Computers, fax machines, telephones, and video monitors are becoming commonplace in the workplace. These machines are transforming the physical workplace into a *virtual workplace* that includes remote customers, suppliers, lenders, reference sources, and other business contacts that a worker interacts with on a daily basis. Work groups are not just the folks around you. *Virtual work groups* link workers in far-flung locations who communicate instantaneously in order to do business.

This is all made possible through desktop fusion. The computer hub and its constellation of electronic devices are becoming a vehicle that can carry workers to distant locations in order to transact their business. As corporations, government agencies, and higher-education institutions go through restructuring and modernization, they are equipping their workers with vehicles that can travel on small secondary roads and, increasingly, on the electronic highways of the wide, wide world. This is a lead that schools should follow.

The Old Paradigm for "Computer"

You are a computing teacher. Therefore you must use a computer. How do you see your computer? Most teachers see the computer as a kind of electronic Cuisinart. You pour information into the computer and—It slices. It dices. It blends. It whips. It purees.

And then it disgorges—onto its display screen, onto a noisy, buzzing printer, or into some peripheral device that blinks a hot red as its innards are flooded with computer output.

Teachers also see the computer as a device that stands still. It may be even bolted to the table that it rests on. Information travels through the computer, and people sit down and talk with the computer. But the computer stands still. It is stationary, fixed, and immobile.

A New Paradigm for "Computer"

The standalone, standstill computer is an old paradigm. This paradigm fits inside the old paradigm for "classroom," but it has less and less to do with the outside world. A new paradigm for "computer" is suddenly emerging. Associated with this paradigm are the concepts: *network, communication, connectivity, multimedia,* and *vehicle.*

We are, overnight, crossing the threshold from personal computing to *interpersonal computing.* In tomorrow's workplace, we will all be using *workstations* instead of mere computers. The word "workstation" implies *communication.* The workstation must talk with the other people and the other machines in the workplace, and it must talk with distant people and distant machines—down the hallway and around the world.

If we couple this concept of a communicating workstation with multimedia, we can see how the computer is no longer a stationary device, but a *vehicle.* Workers can ride that vehicle to a virtual workplace to communicate with their customers and colleagues. Students and teachers can ride that vehicle to the furthest reaches of human knowledge and imagination.

The Computer as Vehicle

In his award-winning novel *Neuromancer* (New York: Ace, 1984), science fiction writer William Gibson sees computers of the future as spaceships that carry hotshot pilots through *cyberspace.* "Cyberspace" is the invisible world of computer data. In the cyberspace of today, most of that data is at a primitive symbolic level, barely above the ones and zeros, on-and-off voltages that form the building blocks of digital code. But in the future, with desktop fusion, computers will transmit photographs, people's voices, movie clips, dazzling three-dimensional models, and animations that appear lifelike and realistic.

Cyberspace will be a virtual, electronic re-creation of the real world, with shocking richness, realism, and authenticity. Laserdisc and software authors face a formidable challenge in ensuring the accuracy and completeness of the sounds and images that will make up this virtual world. As on the recent magazine covers that placed Oprah Winfrey's head on Ann-Margaret's body, and digitally moved the Sphinx closer to its neighboring pyramids, the boundary line between the real world and the virtual will become increasingly transparent.

We are talking of nothing short of "instant electronic publishing." With the right tools from farsighted educational publishers, teachers and students can pilot their computer vehicles onto landing strips located in Prague, Czechoslovakia, underneath the Mediterranean Sea, atop the Galileo spacecraft orbiting Jupiter, or onto the small, bobbing boats that carried the American soldiers across the icy Delaware River during the Revolutionary War.

Sounds like a good PBS documentary?

It is far more.

At the helm of a multimedia computer,

students aren't looking at reality but at *virtual reality*. They can pause any event and instantly replay it. They can capture a video "window," resize it to a quarter of the display screen, and play a second video alongside it. Meanwhile, they can look up an encyclopedia reference and put it into a third window. They can make contact with a professor, policy maker, or architect, and, through multimedia Email, ask them to comment on the materials they are assembling. They can capture the first words of Nelson Mandela the moment he is released from prison, or the sounds of picks chipping away at the Berlin Wall, or the whoosh of helicopter blades as federal drug officials snare a drug runner just off the coast of South America. All these fragments of the real world can be cut and pasted into an interactive *virtual field trip* that the student team is assembling for their classmates, teacher, and local community.

A virtual field trip is an *immersion learning* experience. It reinforces and accelerates learning by placing learners in a rich, multilevel, real-world environment that they can experience with all their senses and that they can analyze using all the tools on the computer.

These tools are already available, and they soon will become inexpensive enough for any school. But they can only be used to their fullest potential if we rethink our notions of "computer" and "classroom." Schools must begin planning now to implement these new paradigms. After all, to travel the electronic highways of the future, students must first have a roadworthy vehicle. Such a machine must be able to communicate, and it must be able to process multimedia data (images, text, sounds, animations, etc.). It must be fast. It must be capable of high-volume (e.g., magnetic and optical) storage. But even with all these features, the machine is still just a box. It does not by itself create a classroom environment that allows teachers and students to use the computer to maximize learning and human development.

A Teacher Explorer Center

Two months ago this column described an inquiry-centered "classroom of the future." The classroom would run on multimedia "wheels" and be capable of carrying teachers and students anywhere they cared to go. It would be based on the new paradigm for "computer" and the new paradigm for "classroom" discussed in this month's column.

Such a classroom is now being created at East Lansing High School, just outside Michigan's state capital. The classroom is known as a "Teacher Explorer Center." It is a pilot training site for Governor Blanchard's "Classrooms of Tomorrow" program that is designed to put computers and other multimedia devices into the hands of more than 20,000 Michigan teachers over the next two years. We hope that many of the Classroom of Tomorrow teachers will come to the Explorer Center for training, along with government policy makers, business leaders, and representatives from higher education.

In the Teacher Explorer Center we are focusing on training teachers as *teacher explorers*—as knowledge navigators who can pilot their classrooms out onto the edge of human knowledge. Teacher explorers will make journeys to places, events, and especially to people. They will reach out and touch experts in the community, in the state, and around the world, and try to see critical areas of knowledge—math, science, geography, writing—through the experts' eyes, as pioneers on knowledge's frontiers and as "hands-on" practitioners who have knowledge not found in any textbook. Teachers will begin their journey by electronically linking up with experts in East Lansing, the nearby state capital, and local universities and community colleges.

Poles of Power

We are now scavenging resources in East Lansing to assemble multimedia "inquiry centers" for teams of teachers and students to use. We are hoping to set up five centers in the classroom: a teacher center and four student centers. Each center sits beside a *power pole*. We think of the power pole as the *entry ramp* onto the electronic highway. Physically, the power poles are simple aluminum poles—hollow shells. Inside the poles are wires and cables for electrical power, local area networking, video networking, cable TV, fiber optics, and telephone lines. Each cable represents a lane onto a different electronic highway.

The Starship Enterprise

Each of the five workstations can take its own entry ramp onto a different electronic highway. One team of explorers can go to Jupiter, another to ancient Rome, a third to the Amazon rain forest, a fourth to an archaeological dig in Asia, and a fifth on a whale watch in the North Atlantic. Each team goes on their journey as "mapmakers" armed with gear (camcorders, VCRs, still-image cameras, etc.) to capture bits and pieces of the real world so they can later analyze, organize, and re-create their journey for others to experience.

Teams are also encouraged to leave their workstation and make journeys to real places and interview real people in the local community.

Each journey is focused on important umbrella themes that organize the inquiry, give it a real-world context, and force the explorers to make decisions faced by real-world experts.

The explorer teams can journey separately, or they can journey together. Imagine the teacher as Captain Kirk on the bridge of the starship Enterprise. Around the teacher are teams of student explorers clustered together at their workstations. Together the teacher and students are on a mission to "boldly go where no one has gone before" —for example, to the future to calculate the effect of global warming on the earth's societies.

All the teams are mapmakers, playing a

supporting role in the classroom mission. One team, the math and science team, creates diagrams to analyze the effect of pollution on global warming. Another team, the Imaging team, gathers satellite images from NOAA, aerial photos, video clips, and magazine photos documenting the extent of temperature changes and worldwide pollution. A third team, the Journal Writers, supervises the first two teams and creates a written and verbal journal describing the class' journey. The fourth team journeys out onto electronic highways and contacts leading experts in the local community, a government agency, and a citizen's action group. They interview the experts and create miniature "expert systems" that simulate the experts' point of view, priorities, and key decisions.

At the end of the class' journey, the teacher has assembled a multimedia database and several problem-solving simulations related to global warming. The class is planning to present their findings as a virtual field trip to other classes and to their parents at the next Open House. They plan to publish their findings on the local public-access cable channel and by sending their findings to the experts they interviewed and to local news organizations.

A Multimedia Skateboard

The Teacher Explorer Center in East Lansing is a pilot classroom of the future that will serve the entire state of Michigan. Not every classroom needs to be this elaborate. The important thing is to begin thinking of your classroom as a room whose walls become "the world all around" (Maurice Sendak, *Where the Wild Things Are*, New York: Harper & Row, 1963). And think of your computer as a vehicle, not as a stationary box that processes data. If you can't afford a high-powered vehicle, don't despair. In fact, it's probably best to begin with something more like a skateboard. You can scavenge your multimedia from around the school. You can create a do-it-yourself version of desktop fusion by putting a camera, keyboard, computer, tape recorder, VCR, and TV together on one desktop. (See earlier "Multimedia Sandbox" columns in *The Computing Teacher* for details.) Next, find yourself a modem. Ask for a phone outlet into your classroom. Or try to get your principal to install cable TV.

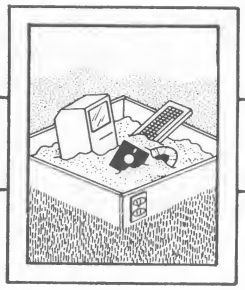
There are several levels of multimedia, each tailored to a certain size school budget. You can:

1. Set up a scavenged multimedia inquiry center in the library as a resource for the entire school.
2. Set up a rolling inquiry center that can visit different classrooms for different curriculum units.
3. Set up a shared inquiry center for two or three classrooms.
4. Set up an inquiry center in each classroom or in a single demonstration classroom.
5. Set up a multimedia "teacher explorer center" classroom with lots of workstations. Teachers and students can schedule visits to the center for special projects and "journeys."
6. Set up a cluster of multimedia inquiry centers in each classroom in the school.

Number one is the least expensive option; number six is the most expensive. However, as you can see, setting up a simple, scavenged inquiry center is affordable even for schools accustomed to operating on a shoestring.

It is time to rethink computers. It is time to rethink classrooms. Look to the year 2000 and create a long-range strategy for your classroom and your school. The year 2000 is still ten years away. You have a whole decade to make your dreams come true. The important thing is to begin.

[Fred D'Ignazio, Multi-Media Classrooms, 1302 Beech St., East Lansing, MI 48823.]



Multimedia Sandbox

Fred D'Ignazio

Getting Started with Multimedia: 16 Classroom Management Strategies

by
Fred D'Ignazio

In the September and October "Sandbox" columns we explored one strategy for keeping multimedia inexpensive—scavenging and scrounging equipment from around the school and assembling it into a multimedia center that can be wheeled from classroom to classroom. Is there a similar approach that makes multimedia simple and glitch-free? Probably not. And such an approach might not be a good thing. Multimedia is a challenge. As a challenge, multimedia can be an opportunity to experiment with new methods of classroom organization—new methods that might increase students' productivity and engagement in the learning process.

Educational researchers are talking about moving from a teacher-centered classroom to a student-centered classroom, a classroom where a teacher is no longer burdened with the overwhelming responsibility of delivering all knowledge and with the impossibility of being the source of all right answers. No human being has enough fingers to press all the buttons, enough expertise to master all the myriad components of multimedia, or enough time to look after all the scrounged equipment. The solution? Call on your fellow teachers and enlist the aid of your students.

Your fellow teachers can form a *support group* to help you cope with multimedia in your classroom. They can help you train students to run the equipment, and they can help you troubleshoot your way through your early multimedia units. Working closely with your colleagues makes it clear that: (1) no one can know everything about multimedia; (2) in fact, often no one knows what to do next (so everyone is free to guess and improvise); and (3) everyone can make a contribution in multimedia.

The same philosophy applies to students. As you know only too well, your students all have different styles of learning. Some are linguistic learners, others visual learners, auditory learners, kinesthetic learners, and so forth. Some are aggressive learners, others timid; some are social and verbal learners, others solitary and silent. The neat thing about multimedia is that it offers an arena for *all* types of learners to succeed—even the marginal learners on the fringes of your class (the troublemakers, emotionally conflicted, learning disabled, the bored, burnt-out, and disengaged).

The key to involving all your students is to set up a structure for self-management. You make it clear up front that if your students abide by this structure they can create multimedia publications and presentations. Make it equally clear that if they abandon this structure then it will be impossible for your class to continue experimenting in this area. Let them know that you need their support since there is no way one person (even a teacher!) can manage multimedia alone. You are turning to them because you trust their good sense and value their creativity, energy, and ingenuity. Tell them you expect learning to be a two-way street; sometimes you will be teaching them, other times they will be teaching you. Tell them that you will play the part of an eager learner, and you expect them to start thinking like "apprentice-teachers."

Here are 16 strategies you can choose from as you plan your first journeys into multimedia. These strategies come from other classroom teachers who are seasoned multimedia explorers. The strategies were picked because they work. However, some strategies may be more appropriate than others, depending on your classroom's unique mixture of students, resources, schedules, and demands.

1 Students as Multimedia Researchers

Focus on a simple method for dealing with multimedia. One successful method is to view students as doing multimedia research (assembling words, images, sounds, etc.) on subjects they are studying in class. This approach allows you to "niche" multimedia into your current schedule and confine it to times already designated for students' written and oral reports. The students continue to do reports, but now you allow them to come to you with *proposals* to turn the reports into multimedia presentations or publications. You help the students prepare their proposals, but you scrutinize

the reports carefully just like any good director of research to make sure they follow imaginative, independent lines of inquiry, and, most of all, are *doable*.

Get the students started brainstorming, planning, organizing, writing, and scheduling their projects long before the equipment arrives. Anticipating using the equipment is a big incentive for students to write, plan, complete their lessons, and do their homework. Use this incentive effectively so students will be prepared to get the most out of the equipment when it finally shows up.

Team/Project Method of Organization

Organize your student researchers into teams of multimedia explorers, problem solvers, reporters, authors, and producers. Work with your students to develop model contracts for teams to sign before they are allowed to participate in multimedia.

Cooperative Learning

Organize your student teams into peer-tutoring groups where everyone learns, shares, and makes a contribution. Cooperative learning can maximize team *and individual* performance in a collaborative, noncompetitive environment.

Critical Thinking

Multimedia is filled with opportunities to develop critical thinking skills. Encourage your students to figure things out for themselves (as individuals and teams). Encourage the teams to experiment, be innovative, and improvise.

The Learner Accepts More Responsibility

Encourage your student teams to be self-reliant, take risks, be independent, and manage themselves with little direct supervision. Many teachers have used this approach to gradually go from a classroom with no teacher aides to a classroom with 25 teacher aides!

Interactive Presentations & Publications

Challenge your students to create interactive reports and presentations. Multimedia is not just a slick way to create one-way, passive, frozen reports. The presentations' outcome should not be fixed or always predictable. Encourage your audience to engage in inquiry, investigation, estimation, hypothesis formation, and hypothesis testing. Spark lively discussions in which your students' performance is measured by their ability to clearly communicate their ideas and stimulate their fellow classmates' thinking.

Thinking About Learning Strategies

Think about organizing *shadow teams* of students to follow their classmates and record their progress. Encourage students to think about strategies of inquiry and what works for each team and for each individual. Have students tape each other frequently, and give students the opportunity to see themselves on camera often. A teacher can tell students to change their behavior, but it is much more effective for students to watch a videotape of their behavior. The videotape lets them see themselves as others see them and hear themselves as others hear them.

Modularity of People & Equipment

The multimedia center can be divided into separate components (video, audio, printing, slides, etc.) among different student teams. You can also divide your students into teams which specialize in research, script writing, planning, publishing, and presenting. Students might further specialize in graphics, video, music, digitizing, narrating, or directing. Encourage each team to borrow "experts" and expertise from other teams. Promote spontaneous and impromptu cross-team collaboration.

The Sandbox and The Explorer as Metaphors

Think about the power of these metaphors to transform the learning environment and to encourage students to self-manage their learning. Multimedia lends itself to learning through metaphors. You and your students should think up fresh, new metaphors of your own.

Teachers as Explorers

Teachers, too, should have plenty of opportunities to play in the multimedia center and go on multimedia explorations (with students and with fellow teachers). Teachers should explore, report back, publish, and present.

Multimedia exploring can redefine the teacher's relationship with students and with old subjects in the curriculum. Teachers and students together can breathe new life into dry, textbook descriptions of knowledge and transform them into movies, radio shows, video skits, multimedia experiments, expeditions and safaris into the local community, and interviews with local "eyewitnesses" to history.

Teacher-explorers and student-explorers can share multimedia responsibilities, learning from each other.

Multimedia on Wheels

Equipment can be placed on *low*, wheeled carts to encourage multimedia to go where it is needed and wanted. Under direct teacher supervision, students can push carts around school. At night the carts can be housed in a book room, supply closet, or in the media specialist's equipment room.

Use Multimedia to Document "How To"

Student explorers and publishers can tape each other during projects to create "video manuals" that document each new technique or skill that is mastered. Using desktop publishing, students publish manuals, quick-start cards, multimedia cookbooks, recipe books, lists of tips and tricks, and "how-to" guides.

13 Carve Out Niches—Break Complex Subjects into Pieces

As explorer teams journey into new areas of knowledge, they do research, experiment, publish, and report back. Teams carve out niches as "experts" in a small domain. Teams develop a sense of pride and ownership toward this domain. Team members teach each other about the domain, then present to other teams and teach them through "maps"—e.g., how-to videos, how-to guides, handouts, and slide shows.

Teams then move on to explore *new* subjects, projects, and domains. In this gradual way, large, complex subjects are gradually explored, and areas of ignorance ("the wilderness") are whittled away. Students' self-esteem rises as they see themselves as scouts, mapmakers, and trailblazers into new areas of inquiry.

14 The Teacher as Wedding Photographer

The multimedia teacher floats among teams acting as troubleshooter, giving encouragement and mini-tutorials, encouraging group process (critical thinking, cooperative learning), and helping students model their behavior as *teacher apprentices*. The teacher models a good learner.

The teacher plays the part of an invisible "wedding photographer" and records highlights of students' efforts and students' progress on videotape. The teacher replays the videotape for individuals, for teams, and for class discussion.

15 Video Report Cards

Each student buys one blank videotape at the beginning of the year. (The teacher can look for videotape sales and discounts and buy quality—Kodak, TDK, Scotch, Fuji, Maxell—videotapes, in bulk, for under $4.00 per tape.) Students tape each other at the beginning of the school year to record each student's current communication skills, self-esteem, knowledge of content areas, and so forth. Students tape each other *before* and *after* each major project. Students tape each other at the end of the year to measure final skills, knowledge, etc. Teacher and students edit tapes together to create a BEFORE and AFTER record of each student's progress during the year.

The tape becomes a personalized *video yearbook* or *video portfolio* for each student. Students take the videotapes home to show parents. Teachers show excerpts from the tapes at Parent-Teacher conferences as a supplement to formal report cards.

16 The Learning Helix

Think of the classroom as a stage or studio in which students are constantly exploring, researching, publishing, presenting, and interacting. When students learn something new they must immediately show what they know as individuals and as a team. (At MIT, this is called RPS—the "Rapid Prototyping System.")

At presentation time, group the student teams in a circle. Have each team present to the entire group, then turn on the video camera and videotape the team which follows it. After each presentation, teams do self-critiques and everyone thinks up creative ways to improve the presentations.

Each team in the circle *immediately* tries to incorporate the latest suggestions into their presentations. The learning circle becomes a learning helix and the students' learning curve goes almost straight up!

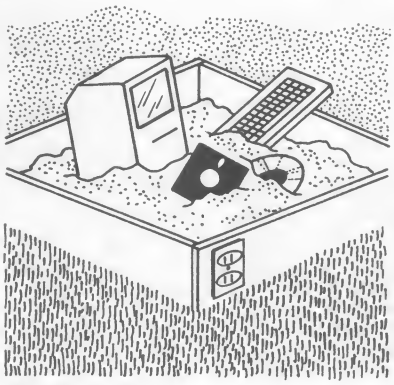
Coping with Multimedia

Remember, all these ideas are simply strategies, not formulas for success. They were invented by teachers like yourself who were trying to cope with the challenges presented by multimedia. Modify what doesn't fit, and invent some new strategies of your own. Above all, hang in there and survive. Practice your coping skills and pass them on to your students. As one group of multimedia teachers said: "Blessed are the risk-takers for they shall surely accumulate experience." The multimedia classroom is an exciting, challenging, exhausting, and exhilarating place to practice teaching and learning. And the results—both for you and your students—are well worth the effort.

[Fred D'Ignazio, 1302 Beech Street, East Lansing, MI 48823.]

Multimedia Sandbox

Welcome to the Multimedia Sandbox!



by
Fred D'Ignazio

This issue inaugurates a new column by Fred D'Ignazio. Fred has been creatively involved with a variety of media. He has authored books and software. His articles and columns have appeared in publications as varied as Highlights for Children *and* The Washington Post. *He has organized multimedia telecommunication links, and written commentaries for ABC-TV, PBS, Discovery Cable, and National Public Radio. His teaching experience includes faculty positions at institutes in Brazil, Portugal, England, Canada, and the U.S. (most recently at Simon Fraser University and Lesley College). Fred has presented multimedia workshops in more than 60 school districts around North America. We look forward to exploring the world of multimedia with such an experienced guide.*

Desktop Fusion

In the next five years computers will become the hub of classroom multimedia centers that fuse audio, video, computing, and telecommunications technologies into a single desktop workstation. With the next generation's high-speed CPUs and optical read-write storage devices, teachers and students will be able to navigate through billions of printed words, sequences of live-action video, photographs, diagrams, human voices, and high-fidelity music as effortlessly as they now scroll through screens of text. They will use their computer as a multimedia publishing center to mix words together with moving pictures and sounds into multimedia "documents." They will be able to publish these documents on paper, diskette, audio cassette, videotape, or laser disc, right in their own classroom. Or they can *telepublish* their multimedia documents over phone lines to distant pen pals and fellow multimedia explorers.[1]

Student and teacher researchers will create and navigate their way through "hypermedia" databases which offer them many pathways through information stored in the computer. They will build the databases from multimedia data, including broadcast TV segments, educational videotapes, live interviews, taped phone interviews, e-mail "eyewitness reports," radio shows, photographs, passages of text, and scanned images taken from magazines, books, and pamphlets.

Applying Multimedia in the Classroom

As with any other technology or innovation, multimedia contains no magic of its own. It can become a valuable tool only when a teacher sees it as merely one element in a well-constructed learning environment. Based on three years of classroom observations, I found that teachers who are the most successful with multimedia introduce it in a learning environment that encourages the simultaneous development of other supportive skills, including:

- cooperative learning.
- higher order thinking skills.
- group problem-solving.
- risk-taking, improvisation, innovation.
- oral and written communication skills.
- learners taking responsibility for their own learning.
- development of learners' self-concept and self-esteem.

In addition, teachers who are successful with multimedia use it as a tool for themselves as well as their students. Depending on their style, some teachers teach themselves multimedia; others learn it from their fellow teachers or from their students. Teachers who are successful find ways to use multimedia personally to:

- make presentations.
- transform textbook materials into a

multimedia format.
- conduct original research.
- bring new life to "tired" knowledge.
- renew their commitment to teaching.

In addition, teachers have raised many questions about multimedia. In this column we will explore

- how teachers do multimedia with one computer and 30 students.
- how *one* teacher can oversee students who are using multiple (audio, video, computer, and telecommunications) technologies.
- whether multimedia will raise teachers' skills or automate teachers out of the classroom.
- how teachers and students who incorporate published multimedia materials into their own works can avoid violating copyright law.
- using multimedia for accelerated learning.
- whether multimedia tools are intended for *teachers* or for *kids*.

The Multimedia Sandbox

The *sandbox* is a metaphor for a learning environment that is emerging in many schools around the U.S. and Canada as we enter the 1990's. In a multimedia sandbox teachers and students see themselves as learners and explorers who sculpt new worlds of knowledge out of the raw materials at hand.

In this column there will be an emphasis on practical techniques, strategies, and ground rules that computing teachers can use to get started in multimedia. Some of the areas we will cover include:

Scavenged Multimedia—Teachers can start multimedia computing on a shoestring by enlisting the help of their colleagues, their students, and the community. They can scavenge equipment commonly found around most schools (including a computer, a TV, a VCR, and a cassette recorder) and assemble a multimedia center that can be wheeled around the school on an AV cart.

Hypermedia—What is hypermedia? How do you do it? How much does it cost? We'll look at hypermedia on the Apple II, Macintosh, Commodore Amiga, and on MS-DOS computers, and suggest some sample lessons to get teachers started.

Digitizing—Multimedia is possible because we now have the tools to *digitize*, or convert, non-computer (video, audio, photographs, and print) media into computer form. We will look at scanners and at video and audio digitizers that can be used in the classroom.

Optical Media—It is getting easier to hook your computer to different kinds of optical media, including linear (e.g., videotape) and non-linear (e.g., videodisc, CD-ROM) media. We will look at ways the computer can interact with video cameras, VCRs, videodiscs, and CD-ROM discs. Such concepts as frame-grabbing, genlock, video overlays, audio dubbing, and editing will be translated into English and evaluated.

MIDI—There is a revolution going on in the field of electronic music that can enrich the multimedia revolution in computers. New MIDI (Musical Instrument Digital Interface) cables and devices make it possible to plug your computer into a musical instrument and create rich sound tracks for teachers' and students' curricular presentations. We'll look at what MIDI offers to the classroom teacher and see how you can get started.

Multimedia Publishing—Multimedia isn't just for student navigators; it's also for student *authors*, *producers*, and *publishers*. We'll look at multimedia authoring systems that teachers and students can use to create their own interactive curricular presentations.

Distance is a State of Mind[2]

In a *real* sandbox, of course, life is not always peachy keen. Think back for a moment. Perhaps there were cold, grey mornings when your mom placed you in a sandbox and you really didn't feel like playing there. Or maybe it had rained, and the sand was soggy and lumpy and scraped against your bottom. Or maybe you were forced to share your sandbox with regiments of ants or a cat who mistook your learning environment for a king-sized litter box.

Picture a teacher and her students wrestling with multimedia cables, trying to figure out why the computer won't talk to the VCR, struggling with image file formats, and grappling with gargantuan sound files which overflow floppy disks.

Now picture a teacher and students sitting at a classroom multimedia center assembling book reports, term papers, and group projects from data captured from *primary sources* all over the world —interviews with real-life experts, modem conversations with teachers and students who live on other parts of the planet, photographs of the students' own town, sounds from the school playground, voices from TV documentaries, and local newspaper articles from the 1930s. Who are these people? The same teacher and the same students!

Multimedia exploring can be a real struggle, but it usually pays off in a big way. Teachers and students who become multimedia explorers get to go where no one has gone before. They get to tackle problems never encountered, gaze on vistas never seen, build structures never imagined. They are the first to explore rich multimedia representations of curricular knowledge. The process is often exhausting–and exhilarating!

What does it take to be a multimedia explorer? Multimedia explorers are no different from any other explorers—they must be risk-takers, mistake-makers, can-doers, and improvisers. They must frequently attempt the impossible. But if they are successful (and they frequently are!), they can fashion a classroom without walls, a classroom in which learners have access to sources of knowledge from around the world, a classroom where distance is only a state of mind.

You are invited to join me on a series of expeditions into the multimedia future. Perhaps you are already experimenting with multimedia and hypermedia in your classroom with your students. As a fellow explorer you are an invaluable resource. Please share with us the sights you've seen, the sounds you've heard, the maps you've constructed, the insights you've experienced—and the black holes you have survived! Take a moment and drop a note (or send a videotape, an audio cassette, or a diskette) to the address below and we will showcase your "scouting report" in future installments of this column.

[Fred D'Ignazio, "The Multimedia Sandbox," 1302 Beech Street, East Lansing, MI 48823; AppleLink: X1110; Bitnet: USERNLLH@SFU.]

[1] Credit for the term "desktop telepublishing" goes to Dr. Gerri Sinclair, professor at Simon Fraser University in Vancouver, British Columbia and a pioneer in desktop telepublishing.

[2] Credit for the phrase "distance is a state of mind" goes to Kathleen Forsythe, Supervisor, Learning and Technology, for the Greater Victoria School Board, Victoria, British Columbia.

Multi-Media Detectives On The Internet

MITN Helps Area Schools Engage in Online Exploration, by Fred D'Ignazio

The Multi-Media Detectives Project (see the October 1994 MITN Update) is a multimedia and telecommunications research effort involving Haslett, Okemos, and East Lansing Public Schools. The project is sponsored by MITN and uses the MITN server to maintain its own World-Wide Web home page:

http://www.mitn.msu.edu/mmd.htm

The teachers and their fourth- and fifth-grade "detectives" plan to gradually develop the home page into an online multimedia gallery featuring students' science research on local wetlands in Meridian Township. Teachers would also like to see their students' web pages feature hypertext and media links to wetlands resources pulled from remote libraries, laboratories, and other research locations around the globe.

To help the students become more competent as web explorers we have begun using two-way cable TV as a control and viewing mechanism. The 2-way cable connection is possible due to the sponsorship of TCI Cable of Mid-Michigan. TCI has set up two-way links in elementary-school classrooms in each of the three participating school districts. A fourth two-way link has been set up in the Multi-Media Classrooms interactive-TV studio in Okemos.

TCI Cable and Michigan State University have installed a high-speed "cable modem" at the Multi-Media Classrooms site. This modem, known as "ChannelWorks," is the size of a small VCR and is made by Digital Equipment Corporation. The ChannelWorks box is attached to an IBM PC via an internal LANtastic Ethernet card and a standard Ethernet cable. A second connection on the back of the box is then attached to normal coaxial cable just like the back of a TV or VCR. Thanks to an online gateway provided by MSU, our project's PC is now on a high-speed network which allows us to send and receive data over the Internet via a full TCP/IP connection. We can transmit and receive data at the full Ethernet speed of 10 Mbits/second—i.e., at 1,000 times the speed of a normal dial-up phone line. This high-speed link makes it possible for our fourth- and fifth-grade detectives to be full-fledged multimedia web researchers using a web browser such as Mosaic.

But how are students able to see the web screens on the computer? After all, the Channel-Works box and its PC are tucked away in a back room at Multi-Media Classrooms, far away from their schools.

Students are able to see the web research pages on their classroom TVs. This is accomplished via the two-way cable link-up which beams the web screens appearing on the computer at Multi-Media Classrooms simultaneously into the classrooms in the three districts. The computer is able to "publish" these screens over television using a MediaLogic box (the Mediator) which translates the computer's RGB video to normal TV (NTSC) video which is then broadcast over the cable line.

The students may be able to see the World Wide Web pages on their classroom TV, but how are they able to control the remote computer located in the Multi-Media Classrooms studio?

Since the cable line is two-way for audio as well as video, the students are able to guide the computer operator at Multi-Media Classrooms just by talking! Each of the two-way cable sites has a standard video camera mounted on a tripod, with a small home-video microphone leading from the camera over a ten-to-twenty-foot extension cord. To change the direction of exploration on the World Wide Web students just talk into their camera microphone, and their voices come out loud and clear in the Multi-Media Classrooms studio.

As a powerful metaphor to help students visualize this highly abstract process, we have been using the popular "Magic Schoolbus" books written by Joanna Cole and published by Scholastic. We liken our cable/web connection to the Magic Schoolbus which enables a classroom full of students to explore the world of science firsthand by travelling anywhere in space or time almost instantaneously. Our Magic Schoolbus is our PC which has been souped up with the addition of the high-speed ChannelWorks box and the high-speed fiber optics connection provided by MSU and TCI. The magic highway which can take us around the globe or even into outer space is, of course, the World Wide Web. In the books the Magic Schoolbus is driven by the students' teacher, the zany Ms. Frizzle. In our project I get to be the "bus driver," and I drive our bus by clicking the mouse buttons on hypertext links which whisk us around the world on the web. And, like Ms. Frizzle in the books, I take requests from the students and drive the bus to research sites to help the students find answers to their science questions.

At another level, our "Magic Schoolbus" is also something quite significant. It is offering an affordable opportunity to explore the near future right now. We are all hearing how we will soon have "video servers" which will be under the control of homes and institutions who are on the information superhighway. But thanks to MITN, TCI, and MSU, fourth and fifth graders in our three districts are already controlling a shared, low-cost "video server" to do collaborative, real-time research at high speed on the Internet.

SERC Receives $2.2 Million from National Science Foundation

Middle school students in the seventh and eight grades will soon have an exciting new opportunity for learning mathematics, thanks to a $2.2 million dollar grant to SERC from the National Science Foundation (NSF).

In announcing the grant, a SERC representative said, "**Math in the Middle...** will use an integrated approach to show that math is, indeed, in the middle of things students see and do every day. Math is somewhere in the middle of every job choice." According to SERC's Executive Director, Gary Vance, students will be invited to explore math concepts within such varied themes as music, design, travel, oceans, health, motion, and nature. The first unit is scheduled for piloting in schools across the nation in October 1995 and will be offered for general distribution in Fall 1997.

Math in the Middle... is a curriculum enrichment course designed for seven units spanning four weeks per unit. Twenty-minute video segments will be supported with on-line computer exercises linking participating teachers and students across the country. Audio forums and printed materials will extend the concepts and skills of the video segments, as well as providing the tools to further explore video topics.

Professional development is a strong component of the integrated approach to mathematics. Teachers will participate in teleconferences and on-line communication to gain knowledge and advice from colleagues. Teachers will also discuss with each other strategies to implement into classroom instruction the national mathematics standards developed by the National Council of Teachers of Mathematics as well as the integration of **Math in the Middle...** into existing curriculum.

G.E. Creates Largest Satellite Operator

GE American Communications, Inc. of Princeton, NJ has completed its acquisition of GTE Spacenet Corp. of McLean, VA. to conclude a deal that creates the nation's largest commercial satellite operator.

The deal gives GE control of 15 satellites and a foothold in the growing business of very small aperture terminal (VSAT) communcations networks. The acquisition was announced June 30 and finalized October 21 after GE received the necessary government approvals.

GE has created a new subsidiary, GE Capital Spacenet Services, Inc., to market the domestic and international VSAT services obtained from GTE.

Source: Space News, October 31-November 6, 1994

Software by Satellite

Hughes Network Systems and IBM have signed a deal to distribute software products electronically via satellite to corporate customers and retail outlets, eliminating the need to ship floppy disks and bulky packaging or to stock store shelves.

The new Hughes satellite service is called DirecPC. The DirecPC hardware kit, which includes a 24 inch dish and connecting gear is expected to retail for $1,495. Subscriber service will cost less than $16 per month, plus user fees.

Germantown, Maryland-based Hughes Network Systems will offer DirecPC in early 1995, after it completes field trials, which started this month and should be finished by January, 1995. The high speed digital infomation delivery service also will transmit documents, desktop video, software, games, news and other information directly to computers.

Source: Space News, November 14-November 20, 1994

Fred D'Ignazio, author, commentator in print and on television, and teacher-trainer extraordinaire appeared twice at the GVS conference. He called his day-long post-conference session, "Chef Fred's Multimedia Kitchen," an apt name for Chef Fred who specializes in whipping up both enthusiasm about what children and teachers can do and multimedia recipes "for the frugal gourmet." "My whole philosophy is all about scavenging: how you can make neat multimedia and distance-learning things happen on a shoestring, using as many materials at hand as possible; so that you don't have to go out and bring in a six-figure type of investment."

Multimedia, Distance Learning, and On-line Networks Can Be Both Exciting and Inexpensive

Fred D'Ignazio on the Art of the Possible

In his session called "Multimedia Detectives," D'Ignazio described a mini-course he is facilitating across three school districts that features live, real-time, two-way exchange of students' voices, video and computer multimedia, all at low cost. The result is what he calls do-it-yourself, Lego block multimedia workstations:

"Rather than having technology wheeled in, in an impersonal way, kids build their multimedia stations from stuff around their building. And what that fosters is something that has nothing to do with all the technical gobbledygook, rather it has to do with the new learning teaching and practices. It imbeds and weaves them into this process of children going around a building, finding tape recorders, computers, and putting stuff together. What they're constructing is a new vehicle for exploration; for research; for authoring; for innovation; for invention; and they're doing it in a collaborative way. This station is then docked with the electronic highways. This station becomes a broadcast desktop studio."

Goldfish Bowls

1994 GVS Conference Highlights

"Schools, I feel, are soon going to be turning into goldfish bowls. A classroom has been this highly insulated, blocked out, cubbyhole kind of environment -- even within a school, much less the community at large -- it's a very opaque kind of thing. That's changing. Within a very short time now, with all the infrastructure thats going in, many schools, and classrooms inside of schools, are going to become goldfish bowls. There will be electronic windows into every classroom. And so the question is, if you're a teacher and you're in these rooms, what are people going to see?"

Expert Detectives

Onlookers into some 'fishbowl' classrooms in Michigan might catch sight of some Multimedia Detectives, a joint project in Michigan between a local branch of the TCI cable company, the Children's Network bulletin board, D'Ignazio's Multimedia Classrooms, and three Michigan school districts. The 3rd and 5th grade detectives gathered information on various aspects of the Civil War. This research was done in preparation for Turner Education Service's 'Electronic Field Trip to Gettysburg.'

The teachers who participated "had a huge amount of respect for the amount of responsibility he or she could transfer onto the shoulders of the children. Glen Devoe, a third-grade teacher, is a particularly extreme believer in that area, so he has what he calls 'experts' ...they're like Nintendo Swat Teams; the experts are his glitchbusters and his techies, and they have different centers of expertise. Telecommunications; he has a cluster of experts who know how to get on-line and then act as coaches for the other kids; he has experts on the video camera; he has experts on multimedia presentation software; these kids run very independently, and at a moment's notice when something goes wrong, the experts swarm over and they make things right."

Legitimate Fears

"Schools have had this image over the years which comes from the 19th Century. A hundred years ago, the school was seen to be this oasis of knowledge, and it was. The school was a center of knowledge and through the teacher as the spigot, the knowledge was piped out into the kids. In today's world it's upside-down. Although school often acts as the information bridge, school is the information-*deprived* environment where most of the information comes in a trickle -- text and talk -- and all these other forms of information zipping across the globe are pretty much outside. There are no downlinks, no ramps into the classroom.

Although school often acts as the information bridge, school is the information-deprived environment where most of the information comes in a trickle -- text and talk -- and all these other forms of information zipping across the globe are pretty much outside.

"All of a sudden that's changing. Schools are getting wired, and schools are developing on-ramps and off-ramps. Pretty soon there's going to be this flood of real-time, electronic multimedia coming into the schools. Its both thrilling and a little bit scary."

"...Teachers have legitimate fears about having a classroom without walls in which everyone can peek in. If you're not broadcasting today, then why not? And there's fear, which I think is very legitimate, of both multimedia computers, and of master teachers who can be beamed in a distance learning environment, and who will be competitive with the physical teachers in the classroom. So the real schools of choice that are emerging are *virtual* schools, the real teachers of choice will be virtual teachers, the real classrooms and curricula and so forth will be virtual."

Practicing What He Preaches. Media Galore

In addition to his straight talk about the realities of multimedia for students and teachers, Fred bombarded his audience with a variety of media: interactive demonstrations, handouts, and child-produced video clips. In one demonstration, he accessed a school's video database by remote control, displaying student artwork and projects. D'Ignazio declared that with this kind of system, "Every room will become a broadcast center."

A video clip told how 4th graders "are taking spreadsheets and dumping the information into a database, taking the database information and throwing it into a word processor, taking that and changing it into a code that's trasmittable over telecommunications, and sending it to other kids."

The student productions he showed included young 'Elementary Explorers' grilling a *Cable in the Classroom* executive on educational issues, high school video essayists interviewing community Vietnam vets on their wartime experiences, and kindergarten reporters asking the eternal question, "What Is a Principal?"

A clip from *Cable in the Classroom*'s 'Learning Matters' program showed Chef Fred putting Julia Child to shame as he unveiled one of his "very in vogue, very 90's" recycling recipes for multimedia. It featured a ten year old beta VCR, a tape recorder, and a duct-taped,eight-year-old video camera with a cat-chewed microphone, all orbiting a seven-year-old computer.

"Our children have been quietly spending the last five years in their bedrooms in 'Nintendo Boot Camp.' ...We should form kids into Nintendo Swat Teams to support their teachers. Teachers can't go to gurus anymore; this stuff is breaking too fast. No single adult can be the expert for any building or any school district."

Co-Teachers, not Wizards

While they accumulate technical skill with their scavenged equipment, teachers and students record what they learn on video or programs like *Excel*, accumulating a library of multimedia tutorials. "So the skills that kids develop at the technical level can be turned back at the curriculum."

The natural result of such a situation is that students become co-teachers. However, it all hinges on students understanding that they must be teachers, not wizards. D'Ignazio was most emphatic in making this distinction: "Wizards go, like 90, and they don't have to share. They don't have to have good communication skills; they don't have to have character or value, or care about the other kids. ...They are being assessed on how well they can nurture and share and coach. Not only in their own room, but *remotely*; and not only help their teacher, but other teachers in remote classrooms."

The final focus of the Multimedia Detectives program is "to take childrens' research seriously and redefine 'authentic assessment' and children's publishing; to make it not a toy and an artificial activity, but an activity that really has value to the children and to the community."

1994 GVS Conference Highlights

"Soft" Architectures for Restructuring: Stretch Your Technology Dollar

Fred D'Ignazio

Ideas for this month's column come, in part, from Sharon Goth-Twe, my colleague in Michigan's Teacher Explorer Center; Larry A. Freds, Director of Dara Services for East Lansing Schools; Larry McGinnis, member, East Lansing School Board; and Dr. William Mitchell, the Superintendent of East Lansing Schools.

East Lansing, Michigan is committed to a restructuring of teaching and learning throughout its ten school buildings. This restructuring will be supported and augmented by a major investment in technology over the next three years. However, although almost six million dollars will be invested in technology, it is hardly enough to buy all the technology desired. The East Lansing school district is considering three dollar-stretching strategies:

Use students' imaginations in place of expensive machines. Students' imaginations are dirt-cheap, yet they are largely ignored. A low-end multimedia authoring station and inquiry center can act as a *motivation multiplier* to dramatically increase students' productivity, participation, and academic performance while saving a district thousands of dollars.

Hire students as "trainers" and "technicians." Students have tremendous multimedia (cabling, troubleshooting, button-pushing, video, and audio) literacies that are being wasted in today's non-multimedia classroom. It's time for school districts to recognize this valuable, inexpensive resource and informally "hire" students as classroom technicians, trainers, and troubleshooters.

This article, which first appeared in *The Computing Teacher,* February 1992, is reprinted with permission of the author.

Fred D'Ignazio is president of Multi-Media Classrooms, Inc., an independent consulting firm working with the East Lansing (MI) Public Schools.

Inventory, modularize, network, and *hub.* Districts can get a lot more "bang for their buck" out of technology by:

- *Inventorying* equipment they already have that can be linked together into advanced multimedia stations.
- *Modularizing* expensive multimedia equipment on carts that can be shared across a building on an on-demand "just-in-time" basis.
- Connecting inexpensive classroom computers to a building-wide *network* that shares scarce multimedia resources and electronically "pipes" resources into the classroom on an as-needed basis.
- Transforming the building's library media center into a multimedia *hub* for multimedia research (capturing, scanning, digitizing, etc.), multimedia networking, instant electronic publishing, and multimedia training.

Restructuring from the Bottom Up

Here is a more detailed summary of some of the "bottom-up" strategies that East Lansing Schools are considering (see Figure 1).

Scavenged Multimedia Workstations in classrooms around the district. "Seed" workstations are supplied by the district. Additional workstations can be scrounged by teachers, students, and parents. They include the following "core-level" equipment:

- Computer
- Video Camera
- VCR
- TV
- CD or Tape Player
- Software
- Wheeled Cart
- Blank tapes, disks
- Dub Cables
- 6-Outlet Power
- Digitizer Card

Transformation of the School Library

Networked Buildings

The Classroom as Starship Enterprise

The Computer as Cockpit

Modular Multimedia on Carts

Student Multimedia SWAT Teams

Scavenged Multimedia Workstations

Figure 1. Bottom-Up Strategy for Restructuring

Student Multimedia SWAT Teams. Over the past five years, millions of children have been in their bedrooms working their way through Nintendo Boot Camp. They are now enormously skilled at "multimedia plumbing." They can mix and match complex cables and plumb audio, video, and computer signals with ease, ingenuity, and amazing speed. School buildings need to enlist these Nintendo graduates as troubleshooters, peer coaches, teacher trainers, and roving technology specialists to take the technical responsibilities for multimedia off the shoulders of the classroom teacher.

Modular Multimedia on Carts. Multimedia resources can be brought into any classroom on wheeled carts containing multimedia equipment that is more scarce or expensive and must be shared across a building. Student "SWAT" Teams can dock the nultimedia carts with the classroom computer and cable the equipment together to create a powerful multimedia workstation in under five minutes. Individual carts might be equipped with one or more of the following items:

- Dubbing VCR
- A laserdisc player, VCR, and TV
- Overhead projector and data display panel
- Video projector
- Video camera and tripod
- Hand scanner and/or flatbed scanner
- MIDI keyboard, an amplified speaker, and a microphone

(Continued on Page 19)

"Soft" Architectures for Restructuring: Stretch Your Technology Dollar

(Continued from Page 18)

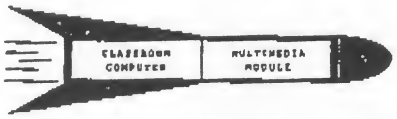
- A CD-ROM drive with a case of audio/ CD-ROM discs

The Computer as Cockpit. For 50 years we have stuck to a familiar model for understanding computers:

We described computers as "number crunchers" and "data processors." In our minds we saw the computer as a *Cuisinart* that slices, dices, purees, and "processes" information.

Now that computers are turning into desk-top PC-TV-CD hybrids (and as they shrink and fit onto our laps, into our pockets, under our desks, and behind our walls), we should search for powerful new metaphors that help us stretch our imagination to recognize radically new human-computer symbioses.

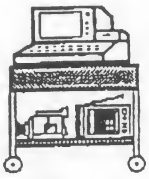
In East Lansing we are replacing the "computer-as-Cuisinart" metaphor with the metaphor of the computer as cockpit. Student explorer teams can pilot their enhanced multimedia stations as "virtual vehicles" to explore and remap their daily lessons into more visual, auditory, lifelike media formats that spark students' imaginations , enhance their understanding of critical subjects, and increase their motivation to learn. Students can take their vehicles to any place or time and learn about subjects they are studying up close, using all their senses, as on-the-spot eyewitnesses.



The Classroom as Starship Enterprise. Student explorer teams can use a classroom network to link their separate workstation "vehicles" into a collaborative super-vehicle for exploration, investigation, and discovery. The teacher can act as the vehicle's "captain" to guide the entire classroom on voyages to explore and map important curricular areas that web or cluster around exciting, powerful themes. The classroom's collaborative mission becomes the creation of interactive electronic field trips and the building of multimedia simulations of real-world processes, events, and phenomena — nothing less than a student-created, multimedia transformation of the curriculum.

CLASSROOM PUBLISHING CENTERS

Multimedia Learning on Wheels!



You can create a mobile *classroom publishing center* that enables your students to publish their work on paper, videotape, audio tape, or computer diskette. You can assemble a center yourself by following the guidelines in this little "starter kit."

An entry-level publishing center includes a computer, a VCR, a TV, a record player or tape recorder, a video camera, and some computer software. You and your colleagues can work together to create a center that is shared among two or three classrooms. Get help from your principal, library media specialist, your students, parents, and the PTA.

You should begin by acquiring one or two wheeled carts so you can roll your publishing center around the classroom and down the hall to fellow teachers' classrooms. A cart many teachers use if the Luxor LE-24 cart from The Highsmith Company, One Mile East, Highway 106, Fort Atkinson, WI 53538.

IBM, APPLE II, MAC or AMIGA COMPUTER

- Two disk drives
- Mouse
- Color Monitor
- 1 Megabyte memory
- Color Graphics Printer

VIDEO CAMCORDER

- Standard 1/2" VHS Format
- Audio, Video Cables
- Charged Battery*
- Battery Recharger*
- Macro Lens
- HQ Circuitry

CAMERA TRIPOD

- Sturdy body*
- Wheels (Dolly)

VCR

- Standard 1/2" VHS Format*
- Audio IN Jack*
- Video IN Jack*
- Audio Dub Button
- Flying Erase head
- HQ Circuitry

TV/MONITOR

- RF IN Jack (Female F-Connector) or VHF IN (two screws)*
- RF Modulator (if only VHF IN)
- Color
- Turn to Ch. 3 or Ch. 4 or set to "VIDEO"

MUSICAL KEYBOARD

- "Output Jack (or "Phones" or "Line Out" Jack
- Casio SK-1 or SK-5 or Radio Shack C-500 or C-650 is STRONGLY recommended.
- MIDI IN, MIDI OUT

HEADPHONES

- Radio Shack Nova 34 ($4.95)
- Radio Shack Nova 55 ($29.95) —much more durable!

MICROPHONE

- Radio Shack #33-1060 ($14.95)
- Radio Shack #33-985 ($21.95)
- Tie-Clip Omni Radio Shack #33-1052 ($17.95)

Networked Buildings. Networking a school building allows teachers and students to use low-end, inexpensive computers as classroom workstations. These workstations can be enhanced by scavenging, by docking with multimedia carts, and by being on a building network that pipes in CD-ROM encyclopedias, downloaded files from on-line information systems, and digitized multimedia files from centralized capture stations in the school library. The network also acts as a school-wide electronic grapevine for constant, intense, student and teacher interaction and cross-classroom communication.

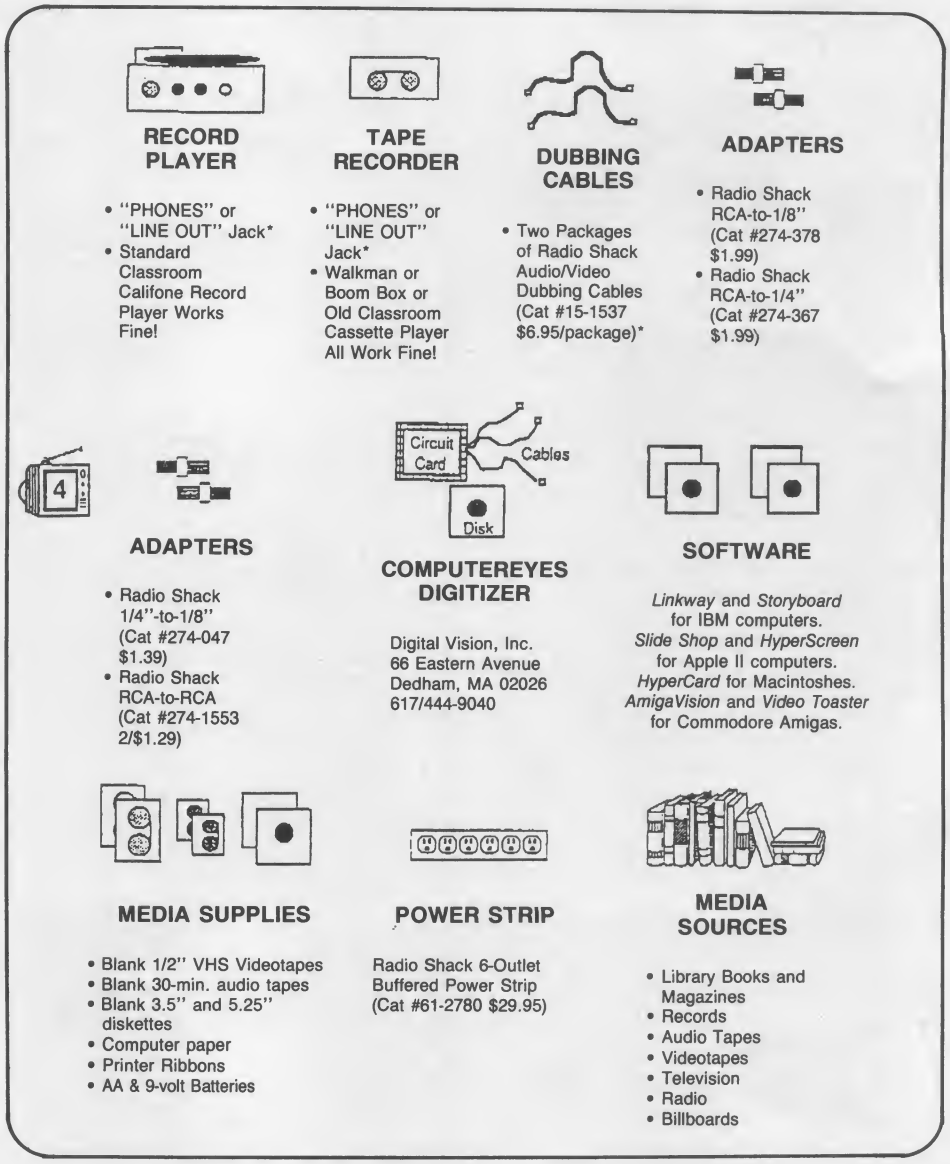
(Continued on Page 20)

"Soft" Architectures for Restructuring: Stretch Your Technology Dollar

(Continued from Page 19)

Transformation of the School Library. Everyone in the school building works together to transform today's text-centered curriculum into new student-created multimedia formats. The hub of a school building's multimedia activities is the school library or media center. Here are some of the core functions of a restructured, "virtual" library media center.

- Maintain and improve print collection materials for use in student research and investigation and as a reservoir for rich language for student oral multimedia recordings and for rich images for student digitizing.
- Acquire a basic collection of digital media, including laserdiscs. CD-ROM titles, major videotape titles, audio CDs (including public-domain "clip sound" CDs for student research and publishing projects).
- Wire library into electronic information sources, including cable TV, Prodigy, CompuServe, TI-IN Satellite Instructional TV, and other distance-learning and online databses.
- Wire the library into all classrooms via computer E-Mail and computer network.
- Centralize all building "multimedia capture" devices in the library, including: color and/or gray-scale scanners; audio capture devices; editing (audio/video dub) VCRs and controllers; cameras (still, Polaroids, video, etc.); cartridge CD players.
- Centralize all building. networking multimedia resources such as CD-ROM optical server "juke boxes" that can pipe up to 28 daisy-chained CD-ROM encyclopedias containing over 7 million pages of information, thousands of images, video and sound clips, and digital movies into low-end classroom computers. Up to 16 classrooms can access each CD-ROM or audio CD simultaneously while on this network.
- Train librarians as multimedia research and publishing instructors. Students and teachers can make appointments to use the library as a multimedia research and publishing center. They can carry their multimedia creations from the library on paper, diskette, or videotape; pipe them into individual classrooms in the form of digitized multimedia movies, images, text files, slide shows, and databases; or tele-publish, via modem, to classrooms around the school district or to remote classrooms around the country or the world. Teachers and students will be able to use the library "after hours" as a training lab. They can learn new software programs and new equipment that later can be wheeled into the classroom on a multimedia cart or "piped" into the classroom electronically. Teachers can practice teaching familiar curriculum subjects using new multimedia teaching aids. They can experiment creating new classroom presentation materials and interactive "templates" for student assignments. Students can gain practice creating multimedia term papers, book reports, science projects, and prpesentations.



(Continued on Page 21)

"Soft" Architectures for Restructuring: Stretch Your Technology Dollar

(Continued from Page 20)

KISS and the Big Picture

Over the last five months, this column has been platform for looking at the topic "restructuring using technology" from a practical yet innovative perspective. If your district is interested in using technology (and, specifically, multimedia) to act as a catalyst for restructuring, then you should collect these five columns. Together the columns cover "the big picture" and propose that school districts:

- Create a centralized facility (a Teacher Explorer Center or transformed school library media center) to begin the daily exposure of teachers, students, administrators, and parents to new ideas and new teaching and learning tools.
- Set up a district-wide training program (Pioneers, Explorers, and Settlers) that helps the district prioritize its limited training dollars for maximum impact and effectiveness.
- Design a program to funnel students' vast technological aptitudes and literacies into the restructuring process (e.g., through student multimedia trainers, Nintendo "SWAT" Teams, teacher-student contracts, etc.).
- Link the various "soft" architectures for restructuring covered in this article with the "hard" capital-intensive architectures of planning for new buildings and expensive new equipment.

To get started, keep your sights set on three fundamentals:

1. Encourage your teachers to take a leadership role in the change process.
2. The classroom is where learning takes place, so focus on the classroom, on students, and on learning itself. The rest will fall into place.
3. KISS — Keep It Simple to get Started. Keep It Simple to Succeed. □

when teachers discuss their ideas with each other informally, says Lou Cenname, a vice principal at two district schools. That was the idea behind Apples for Teachers; expose teachers to technology, and they will become the experts and pass their knowledge on to their colleagues.

—Daniel Gursky

ON A SHOESTRING

CHIQUITA MARBURY REMEMBERS WHEN Fred D'Ignazio came to Jefferson County, Ala., four years ago to train her and other teachers to use "multimedia" technology. "I thought he was like a little kid who had visions from Star Wars," says Marbury. "But now I can see and do the things he talked about."

D'Ignazio travels across the country, talking to teachers in more than 40 states and Canada about making the most of available equipment. "Scavenger" and "sandbox" are two of his favorite words. Teachers, with help from students and parents, play the role of scavengers, rounding up technological items found in almost every school: computers, videocassette recorders, televisions, video cameras, cassette recorders, and headphones, to name a few. With some simple instructions on hooking things together, teachers in D'Ignazio's workshops are encouraged to have fun with their equipment—so much fun it's like playing in a sandbox.

"Many teachers think they're in the backwaters of technology," says D'Ignazio, who runs the Teacher Explorer Center in East Lansing, Mich. But he shows them how, with a few inexpensive cables and adaptors, they can make computers talk to VCRs and record players play out of TV sets. "After one day of training, it's a whole new world," he says. "They feel like they're on the cutting edge."

With their new-found proficiency in creating low-cost multimedia centers, teachers can spice up their own lessons and show students how to create high-tech video book reports, term papers, and science projects. "The teachers who respond to my appeal are highly motivated," D'Ignazio says. "They're not technologists, but they work hard."

Marbury, who teaches at Hewitt Elementary School in Trussville, Ala., is the sort of person D'Ignazio loves to work with. Since that first workshop, she's gone on to conduct multimedia training herself, not just in her district and state but also all over the country.

If anyone understands the constraints of tight budgets, it's Marbury. Her district called its multimedia project "On a Shoestring," but it was really "just the tips of the laces," she says. Most teachers she trains have access to more money and better equipment than she does, but they don't know how to use it. That's where Marbury comes in. "They have no idea what the equipment will allow them to do because they haven't been trained," she explains.

Marbury makes a point of telling teachers that they shouldn't be afraid to learn from their students, who are often quite sophisticated about technology. She tells them, for example, how one of her 3rd graders has created an elaborate interactive video project on the life and music of Beethoven.

Teachers listen to Marbury because she relates her own classroom experiences. "I'm not a guru who doesn't know what it's like to have bus duty

DAN LAMONT

Technology coordinators like Carolyn Munn are at the heart of the Lake Washington schools' training program.

after school," she says. "They know I get dirty with the kids just like they do."

—Daniel Gursky

COUPON CLASSES

SHOPPERS LIKE COUPONS. GROCERY stores have known that for a long time. The Farmington, Mich., public schools have discovered that teachers like coupons, too.

The school district advertises its popular in-service training programs through coupon books. Each year, every teacher receives a book describing all of the inservice offerings. Technology workshops run the gamut from desktop publishing and software previews to computer maintenance and video editing. Teachers sign up for the one- or two-hour courses by sending in the appropriate coupons.

The classes are voluntary, but most Farmington teachers enroll in at least one. "Teachers are there because they want to be," says Virginia Cheek, a media specialist at Wooddale Elementary School, who teaches some coupon classes. "They want to use the program to benefit their students." Cheek also offers follow-up help for teachers who need it.

The district boasts a strong video-training program, thanks in large part to Dean Cobb, a mass media teacher and telecommunications director at North Farmington High School. "It's not only a nice way to record family history," he tells teachers, "but it can also be a very creative tool in the classroom." About 65 percent of teachers and parents in the district have camcorders, he estimates, so teachers just need some training on production and editing to bring their creative ideas to life through video. Because Cobb runs the district's TV studio, which is hooked into the local cable system, he can also offer teachers and students an added incentive: a chance to see their work broadcast.

In addition to the coupon program, each summer Farmington combines forces with a neighboring district to offer a variety of technology classes. The districts share expenses and instructors, and the teachers have a chance to meet new colleagues. The district also holds a technology fair one evening each winter that usually attracts hundreds of teachers who demonstrate and discuss equipment and programs.

District officials would like every teacher to have a computer, but there isn't enough money. So, for the past two years, the school system has convened a jury of district employees to decide who will receive computers. Individual teachers or departments apply to receive a workstation, which usually includes a computer, printer, and cart, as well as an allowance to buy software. Applicants describe how they intend to use the equipment in their classrooms and also specify the training they would need to use the equipment effectively. Before the winning applicants receive their computers, they must complete the training.

"You have to make the connection between training and awarding equipment," says district computer coordinator Richard Strausz. "We've taken people who were reluctant or apprehensive and turned them into real technology junkies."

—Daniel Gursky

'T' TO THE THIRD POWER

WHEN THE NEW YORK STATE DEPART-ment of Education decided to make a major investment in educational technology, it did not funnel money directly into the schools. Instead, the department created centers where teachers could learn about different technologies and how to use them. The state now spends $21.5 million a year funding 111 such centers, where teachers—not consultants—train their colleagues. "We call it 'T' to the third power: teachers teaching teachers," says one center director.

The centers are located in a variety of settings, such as schools, college campuses, shopping centers, and buses. Most house a wide range of equipment, including computers, software, telecommunications devices, CD-ROMs, robots, scanners, videodiscs, televisions, videocassette recorders, camcorders, tape recorders, cameras, interactive technology, and other state-of-the-art instruments. Teachers check out the equipment year-round on a library-loan basis.

Statewide and international telecommunications networks link all the centers, and teachers can access computer bulletin boards and databases. Some centers also tap into a regional network, which is especially valuable to rural teachers.

Most important, the centers enable teachers to familiarize themselves with the latest educational technology. Once teachers know what they like, want, and need in their classrooms, they are better able to convince their districts to purchase it. (Some teachers also buy computers and other technology for professional or personal use through the centers, often at greatly reduced prices.)

The effect has been empowering. "The centers have totally changed my life," says Linda McGuire, a teacher-in-residence at the North Country Teacher Resource Center in Plattsburgh. McGuire taught computer programing at Ausable Valley Central School in Clintonville, N.Y., but she is on leave to coordinate teacher workshops and a telecommunications project. "I've become so involved in so many things I knew nothing about before," she says. □

—Lisa Wolcott

GUIDE TO

MULTIMEDIA: HOW IT CHANGES THE WAY WE TEACH & LEARN

Everything you want to know about the "M" word, including benefits, costs, products, research, and more

By Isabelle Bruder

Ask and almost anyone will tell you that multimedia is the combination of video, sound, text, animation, and graphics with a computer to tie these components together. With multimedia, teachers create exciting and effective learning environments where students are active participants rather than passive recipients of information.

But most of you know that. Or at least you suspect it, because multimedia incorporates technologies that are, to a large extent, already a part of your culture. Computers, videodiscs, CD-ROM, video cassette recorders, television, video cameras, printers, software—to name a few—all are technologies used in schools and all are inherent to multimedia.

So, the basic definition of multimedia is well established. What is not so readily understood is the extent of multimedia's ability to help better educate students. In other words: Does multimedia work? Almost all of the dozens of educators and industry people interviewed for this article answered with a definitive yes.

However, there is no current research that says multimedia works, and many questions persist. Have educators or the companies that produce multimedia products really stopped to think about the purpose of multimedia? Or is there simply a growing trend to gather together all available technologies, repackage or repurpose them, and use them without true consideration for pedagogical value? Is multimedia simply a trend? Finally, what will multimedia look like in the future?

Moving Too Fast?

According to Mary-Alice White, director of the Electronic Learning Laboratory (no affiliation with this magazine) in Salisbury, Conn., "schools are under siege with all this technology" and there is mounting concern that not enough users of multimedia have paused to consider the consequences.

"We have all these emerging technologies coming at us so fast that we haven't really thought through how to use them, and particularly how to use them in a worthwhile way," White says. "At this stage we don't know whether multimedia helps the learning process. I think it's going to, but we just don't know."

Fred D'Ignazio, president of Multimedia Classrooms, Inc., East Lansing, Mich., shares White's concern, but adds: "Education is a faddist profession. We tend to get into these

BENEFITS

Does Multimedia Really Make A Difference?

Why use multimedia technology instead of more traditional classroom tools? Based on interviews with dozens of educators and industry people, here are some of the benefits—to both student and teacher—of using multiple, integrated technologies in the classroom.

Multimedia . . .

- **Reaches** all the senses, which enhances learning. Multimedia can be tailored to the learning styles of individuals, whether they are visual, verbal, auditory, or physical learners.
- **Encourages** and validates self-expression. By allowing students to decide how they want to create a project—through words, images, sound, etc.—teachers are saying it's OK that students have more control and more of a voice in their own learning process.
- **Gives** a sense of ownership to the user. Students actually create what they learn, and there is often physical evidence, such as a portfolio of work, of that learning.
- **Creates** an active rather than passive atmosphere because it forces the student to participate and think about what they are learning. "Engages the disengaged," says one educator.
- **Fosters** communication. The use of multimedia starts conversations between the students and teachers and allows ideas to flow in ways that may not always be possible through words alone.When a student creates what he's learning, he will probably feel more comfortable with it and want to discuss what he's done with those around him.
- **Makes** sense. Technology is already built into the lives of today's students (television, radio, phones, computers), so it is something they feel comfortable with.
- **Is** a lot of fun!

Illustration by Laurence Gartel

things and get very excited, then inflate the usefulness of something, find we've inflated it, get resentful because we feel we've been taken, and then go looking for something else. Multimedia will have to go through that cycle to some extent."

Part of the reason for that cycle of experimentation, discovery, and reinvention is that multimedia is still too young to have been tested and conclusively proven effective in research labs. (See box, page 24, for more on research.) Even those using it for years, like D'Ignazio, agree that "there is no integrated, single approach and certainly not one that says, 'This is the way you use multimedia.' It's a market open to diverse and sometimes homegrown approaches," says D'Ignazio. "But that's what personal computers were for a long time."

Why It Seems to Work

Homegrown approaches in classrooms around the country have become the unofficial testing ground for multimedia—with positive results. Stories abound of ultra-motivated students and rejuvenated teachers working interactively, manipulating and creating projects, producing concrete examples of things they have learned.

According to Elliot Soloway, associate professor of electrical engineering and computer science, University of Michigan, Ann Arbor, in classrooms using multimedia, learning becomes an active process where the student uses the technology to communicate his understanding of a subject to those around him. Often, as a result, classroom structures change. Seats set in rows start to form clusters where teams can work. Teachers may adjust methods to become navigators, no longer feeding information to students for storage and regurgitation on tests. And students are expected to take information in, process it, and put back something of themselves that says yes, they understood what it was they've been exposed to.

"It's a constructive, not instructive process," says Soloway. "Kids can't just be presented with images. They must be able to create with images the things they are learning, because you actually learn by doing."

At the Ralph Bunche School, New York City, for example, sixth-grade students have used multimedia to create their own half-hour news show, Kid Witness News. Paul Reese, computer coordinator, says, "I use multimedia very little in the presentation mode because most of its value is in the kids doing it themselves."

Multimedia supports all the multiple intelligences not necessarily supported through a text-dominated environment.

– Fred D'Ignazio

Doing a news show, says Reese, students may use Grolier's Encyclopedia on CD-ROM to research topics, then use word processors to write and edit the script for the show. The videotaping is done by students with advisor supervision. Final editing requires some help from advisors, and then students view the completed production on a VCR. A simple multimedia project like this, says Reese, allows them to express their views through the topics they choose (one show featured a UNICEF meeting at the United Nations and an international track meet at Madison Square Garden) and the way they cover those topics.

One of multimedia's most touted charms is its ability to stimulate self-expression. Soloway—also director of the HiCE Research Group (Highly Interactive Computing Environments) at the university—says that the issue isn't at all whether or not multimedia is good for learning, but rather "how to let students use it to generate a *sense* of ownership, self-expression, participation, and communication. That's

COSTS

Multimedia Technologies: A Primer

Here's a listing of some technologies you might find in a multimedia classroom. The prices are estimates so you might find even lower prices. And, if you're really wondering where to begin, the simplest and most common use of multimedia today is a combination of a computer, videodisc player, and TV.

- **Computer**: Get a model that includes the CPU, keyboard, operating system, a color monitor (black and white's not recommended for multimedia) and a hard disk drive. $1,000 to $2,500. [High-end models cost more.]
- **Hard drive**: A necessity and, if not already included with the computer, costs $200–$500.
- **Mouse**: If the computer you bought doesn't have one, it's a necessity. $50.
- **Videodisc player**: Get a level one or level three. $800–$1,000.
- **Television**: Minimum 25-inch screen; great as a display with a VCR. $300 and up.
- **Printer**: Should have graphics capability and color ribbon; dot matrix printer works well, but you can also use an ink jet or laser printer, which may cost more. $400 to $1,000.
- **Scanner**: To input images from a flat source, such as a photograph, illustrations, or text use a hand-held or flatbed scanner. Prices vary.
- **Video camera**: Captures three-dimensional and moving images, which you can later scan into a computer using a video digitizer. $400 and up.
- **Video digitizer**: Transfers non-computer images (images from VCR, TV, videodisc, etc.) to computer form. $100 to $600.
- **Audio digitizer**: Transfers sound to computer form. $150 to $500.
- **Speakers**: Get speakers for the computer if they aren't already built in. Cheap.
- **CD-ROM drive**: $400 to $800. (Some computers need a SCSI card, about $200, to hook-up the CD-ROM drive.)
- **VCR**: Great as a display device (instead of a projector) used with your TV. $200 and up.
- **Sound source**: A tape recorder or record player. $20 and up. (Don't forget the cables.)
- **Keyboard**: Add music to your life for $40 to $500. And with a $5 cable, can connect to headphones jack on VCR.
- **Telephone**: Because the multimedia station is, *after all, a communicating* station. $20 and up. You can also do a lot with just a phone jack and cable, $5.
- **Modem**: $75 to $250.

— Compiled with the help of Fred D'Ignazio, Multimedia Classrooms, Inc., East Lansing, MI

Photograph By Randy Edmonds

what it's about. If technology can play on those intrinsic motivators, we'd be nuts not to use it."

D'Ignazio concurs with that assessment. Multimedia, he says, "lets you reach out and try to understand any subject and then communicate your understanding in ways that are far more powerful and human than words alone. Multimedia supports all the multiple intelligences which are not necessarily supported through a text-dominated environment."

For example, D'Ignazio explains, a teacher using a text-dominated method to teach students about whales might use a tiny picture and a paragraph of information. "But the reality for anyone who then leaves that classroom and finds a whale, is that 'whale' is not a tiny picture and a paragraph." With multimedia, he adds, "a teacher can use a videodisc or CD-ROM and a computer to show the size of a whale and the mammal in motion, and students will walk away with a broader understanding of what 'whale' really means."

D'Ignazio—who conducts daily, six-hour multimedia workshops with teachers—has discovered that multimedia "is a lot of fun for teachers, and it reignites the things that made them want to become teachers. It actually fights teacher burnout because it's a positive force in their lives," he says.

Soloway, who has been working for three years on a HiCE project at Community High School, Ann Arbor,

PRODUCTS

Recently Released Multimedia Products

Tandy Multimedia PC Family
Based on the specifications announced last year and using Windows 3.0., Tandy's five new multimedia computers boast floppy drive, hard drive, internal CD-ROM drive, and processors ranging from 80286/16 MHz to 80386/33 MHz. Costs (without monitors) from $2,599 to $5,499. (Tandy/Radio Shack, Fort Worth, Texas)

English Express
An English as a second language multimedia program available on CD-ROM or videodisc. Contains 1,400 color photographs grouped in 67 categories. Grades 5 through adult. See review, page 40. (Davidson & Associates, Torrance, Calif.)

Desert Storm: The First Draft of History
A multimedia magazine on CD-ROM, following the Gulf Crisis as covered by *Time* magazine. Contains the equivalent of 6,000 pages, including dispatches from correspondents, audio recordings, and photographs. Indexed chronologically and by subject matter. $39.99. (Time/Warner New Media Division, Burbank, Calif.)

The Western Civilization Videodisc
This videodisc resource on the history of Western civilization includes 2,100 barcoded still images. Covers areas such as Middle Ages, medicine, science and technology. Preview sets available at no cost. Videodisc and resource book, $595. (Instructional Resources Corp., Annapolis, Md.)

Science 2000
A yearlong 7th-grade thematic science curriculum divided into four units, Science 2000 is based on the California Science Framework and Project 2061, an assessment of science curriculum needs from the American Association for the Advancement of Science. Includes videotape, two double-sided videodiscs, Macintosh or MS-DOS-compatible software, hands-on kits, and teacher's guide. $5,000 complete. Components are also sold individually. (Decision Development Corp., San Ramon, Calif.)

Discovery Interactive Library
The first three videodiscs from the Discovery Channel's Interactive Library are scheduled to ship this month. The discs are: *Investigating History: Treasures from the Deep* (social studies); *Investigating Science: Treasures from the Deep* (science and technology); and *Insects: Little Giants of the Earth* (natural science). Disc and classroom guide, $195; disc, guide, and software, $295. (The Discovery Channel, Bethesda, Md.)

Sony Laser Library
Six CD-ROM discs from a variety of companies bundled with a Sony CD-ROM disc player. The Sony Laser Library includes: *Compton's Family Encyclopedia, MAMMALS: A Multimedia Encyclopedia, Microsoft Bookshelf Reference Library 1991 Edition, Mixed-Up Mother Goose, Languages of the World,* and *The Software Toolworks World Atlas.* (Sony Corp. of America, San Jose, Calif.)

RESEARCH

Multimedia Probably Improves Instruction, But No Conclusive Data Yet

Is multimedia an effective instructional tool? Jon Young, a professor of Computer Education/Cognitive Systems at the University of North Texas, Denton, believes that multimedia is at least as effective today as other methods of teaching and learning, but he has no proof.

"I'm not aware of any conclusive evidence that indicates multimedia is a superior delivery system," says Young, "but there's lots of anecdotal evidence which indicates that it probably is."

Young is a researcher in the Multimedia and Emerging Delivery Systems Lab at the Texas Center for Educational Technology, located at UNT. The dual mission of the lab is to study ways to effectively integrate multimedia into classrooms and evaluate emerging technologies. What *is* known is that when learning involves all the senses—as multimedia does—the student and teacher are probably better off. "There are some strong imprints tosuggest that the more sensory modalities used, the better the task is going to be learned," Young says.

Mary-Alice White, a psychologist who directs the Electronic Learning Laboratory, Salisbury, Conn., agrees that it is too early to tell if multimedia is a more effective tool.

"All of this [multimedia use] is well ahead of any kind of research," says White. "Research data get published about two years behind anyhow, and in this field, research lags. I think it'll be some time before we figure out which does what best."

But why, since many of the components of multimedia—computers, videodiscs, and VCRs etc.—have been in use for some time, is there no research? Young says there are at least two obstacles to finding some real differences between multimedia and other systems of instruction.

"One is that we are still very weak at controlling variables that have to do with human learning, such as the student's knowledge base and the effects of the home environment. I don't know if ever we'll be able to measure those things. It's really hard to get conclusive statistics."

The other reason, he says is that "most of the multimedia stuff that's being developed now is experimental, and people are just playing with it. This isn't critical necessarily, but we don't have clearly defined objectives, clearly defined cognitive processes that we can track as the student works through it. We just haven't gotten to that point."

What, if anything, has been concluded at the lab?

"We've been getting some pretty good statistical results," says Young, "that laserdisc technology is a better way to go than just the traditional classroom environment. And I suspect we're going to get that same impact from other multimedia platforms."

Q & A WITH FRED D'IGNAZIO

Editor's Note: *Fred D'Ignazio, president of* Multimedia Classrooms, *answers teachers' questions about the cost, accessibility, and educational benefits of multimedia in today's classroom.*

Q I'm interested in incorporating multimedia into my teaching. But I'm not sure where to begin. Do you have any suggestions? — *Deborah Reineke, English teacher, grades 7 and 8, Chatham Junior/Senior High, Chatham, Mass.*

A The first thing teachers should do is to take a look at traditional classroom activities, such as an American history report, and see how they can be expanded to incorporate multimedia. For example, by connecting a VCR to a computer, students can create computer graphics and text, record their data on tape, and display the report on a television monitor. Students can also add a narrative to the report, which not only increases oral language skills, but also adds another aspect to multimedia. Many computers have special effects capabilities. The Amiga, for instance, has one of horses galloping, which could accompany a student's narrated report on the frontier days.

■

Q Since funds are usually limited, what is the minimum equipment I'd need to set up a multimedia classroom, and are there ways to acquire equipment without breaking a school's budget? —*Jane Bauserman, fifth-grade teacher of the gifted, Madison Gifted Center, Norfolk, Va.*

The multiple faces of Fred D'Ignazio, educational consultant, as he answers teachers' questions on his favorite subject—multimedia.

A I think the first step is to scavenge. You'd be surprised at what already exists in your school. The big myth about multimedia is cost. It doesn't have to cost thousands of dollars, especially if you are just getting started. Most schools have tape recorders, VCR's, and even cameras or camcorders. Look around for things that aren't being used, and pull them around your computer. Use your computer as a hub. Now, granted, you may not be able to use all of these components every day, but odds are your school has equipment you can reserve. And if your school doesn't have a VCR, or camcorder, appeal to the PTA, as parents can be a good source for lending equipment.

■

Q What subject areas are good for utilizing multimedia? — *John Donlan, fifth-grade science and math teacher, Chesterfield Heights Elementary School, Norfolk, Va.*

A One area that is very good is math, especially in the area of story problems. The students can create and illustrate their own story problems on the computer. Then, by hooking the computer up to a VCR, the whole class can view the illustrated story problem, and you can use the pause button during the presentation and challenge students to solve the problem. Another good area is social studies. Events from American history can be recreated by the class. Begin by having students create an outline and write a script. This helps to improve writing skills. Then have the dramatic presentation taped for viewing by the class. When the presentation includes audio, students can hear their own voices, which can improve oral skills. One of the big

"There is no need to spend thousands of dollars on technology. Many schools presently own equipment, like VCRs, that can be used in multimedia presentations."

PHOTOS BY RANDY EDMONDS

advantages of multimedia is that it combines more than one curriculum area. A social studies project can also teach language arts at the same time. Every subject can utilize multimedia. And multimedia usually teaches more than one subject at a time.

Q Our school has computers, but one of the problems is repairs and maintenance of the equipment. Our school board is reluctant to allocate money for repairs. It seems to me that multimedia means more equipment, thus, more repairs. Is this true, and if so, are there ways to keep repair costs down? — *Karen Diaz Navarro, ESL and language arts teacher, grades 3-6, PS 155, New York, N.Y.*

A Most of your cost in this area comes from carelessness and theft. Many teachers develop contracts with students, which recognize the students as co-producers, and therefore, directly responsible for the equipment. Putting the responsibility in the hands of the students gives them a feeling of ownership. Believe me, students respond to being put in a position of trust. Another technique is to enlist your local VCR dealer. Get them to adopt your school. Their part of the arrangement is to repair damaged equipment for free, or for cost. The school, in turn, with its multimedia capabilites, can create pamphlets for the business, or produce a public relations videotape. I saw this done in a district in Alabama where 13 schools were serviced by a local business. The VCR dealer felt he was really contributing to the community and at the same time getting some good public relations. Another avenue to explore is fund-raising. Students can create T-shirts with personalized slogans or illustrations that can be sold. You use a transfer program that prints the ink right on the shirt. Or you can print the image backwards on a piece of paper and iron it onto the T-shirt.

Q With multimedia, don't students just receive mostly random learning about a given event, rather than a broader scope about how it relates to other events? For example, a multimedia project on the Battle of the Maine would certainly increase knowledge on one aspect of The Spanish-American War, but would students grasp the historical significance of that war as a whole? — *Deborah Reineke*

A My response to that is precisely the opposite. Multimedia is about connections. Today, knowledge is often taught within very narrow boundaries. For instance, history is just history or math is just math.

"Multimedia encourages interactive education. Students share each other's creativity and responsibilty to produce projects designed to increase knowledge."

Multimedia emphasizes teaching across the curriculum by taking a topic and connecting it to the larger picture of what is going on in the world. In history, for example, if you are doing a lesson on a specific historical event, multimedia helps to connect the textbook lesson with images from the era, or speeches that give students a more realistic picture of what the world was like at the time. Events in our world, present and past, are not isolated unto themselves. Events involve, at least, a combination of history, economics, and sociology. Multimedia has the capability to combine all those aspects, offering a much broader view of historical events.

Q What is the single most significant benefit multimedia has to offer students? —*Deborah Reineke*

A I think the most significant benefit of multimedia is children working and learning together. We tend to get bogged down by the technology without realizing multimedia encourages interactive education. Students share each other's creativity and responsibility to produce a project designed to increase knowledge. All my school projects were done in isolation. I did my own book reports and my own essays. With multimedia, students can combine their talents for a group presentation to the class.

Remember going in single file to the auditorium and passively sitting through a film on insects? Well, now kids are making the films, or I should say videos, and it is a much more interactive participation.

I'm not suggesting students shouldn't produce any work on their own, but in the adult work-a-day world, you must be interactive with other people. Multimedia teaches that, and can be a tremendous tool in preparing students for adult life. ■

THE TO
MULTI

Multimedia requires equipment. This guide explains the equipment used in multimedia, and labels it as beginner ●, intermediate ●, or advanced ● level. A cost guideline is included as well, with low and high end figures given. These prices are for machines compatible with Amigas. It should be noted that costs can go

1 SCANNER

A device that enables a computer to read text or graphics from a page and put the text or graphic into a computer. Prices range from just under $2000 for a black and white scanner to $7,000 or more for a high quality color scanner.

2 MONITOR AND VIDEO CASSETTE RECORDER

A monitor is used to display video programs; a video cassette recorder is used to record television programs and to playback student-produced or commercial videotapes. Black and white monitors can be bought for as little as $100; color monitors usually are priced between $350 and $700. VCRs are priced as low as $200 and can cost up to $1,000 and higher.

3 VIDEO DIGITIZER

A device which can transfer non-computer media, such as photos or videotape, into computer form. Prices range from around $200 to $600.

4 AUDIO DIGITIZER

A device which can transfer sounds into computer form. Prices range from $150 to $500.

5 VIDEOCAMERA

Used for filming. Basic cameras are available for as little as $500 and more sophisticated models can go as high as $2000 and more.

ILLUSTRATIONS BY KENN RICHARDS

OLS OF MEDIA

higher for more sophisticated equipment. Likewise, comparison shoppers may be able to find some equipment at prices even lower than are listed here. This brings up a good point about purchasing equipment. Shop around when looking for multimedia equipment and always inquire about educational discounts when speaking with vendors or local dealers.

6 COMPUTER

Computers best suited for beginning multimedia presentations can usually be purchased for just under $1,000. Higher end computers with advanced capabilities can run up to $4,000 and more.

7 MAIN STORAGE DEVICE

A disk drive for storing information. As multimedia projects incorporate more advanced components, such as digitized images, a computer's memory can quickly be used up, thus necessitating additional storage. Prices are compatible with storage capabilities and range between $200 and $600.

8 LASER PRINTER

The high-end in printers, it uses a laser beam to generate images. A quality printer can be purchased for about $1,000. The higher-end models go for about $5,000–$7,000.

9 MUSICAL KEYBOARDS

Enable an original musical component to be added to a presentation. Prices range from $100 to $1,000.

10 TELEPHONE AND CASSETTE RECORDER

The telephone, when connected to a modem, allows students to access research on-line and to collaborate on projects with other computer users. A cassette recorder enables the introduction of audio into multimedia projects at a low price. Telephones and cassette recorders begin as low as $20. ■

TECHNICAL ASSISTANCE BY RICK BROIDA